Soil Survey

of the

EAGLE RIVER VALLEY
British Columbia

by

A. B. Dawson and C. C. Kelley

Interim Report

Map Reference:

Soil Map of Eagle River Valley
Sicamous to Three Valley Lake.
Scale: 2 inches = 1 mile. 1964

British Columbia Department of Agriculture
KELOWNA, B. C.
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Participating soil survey staff were J. Cotic, V. K. Comar, and M. J. Romaine. Laboratory analyses were undertaken by V. E. Osborne.

INTRODUCTION

The survey of the Eagle Valley was undertaken as part of the pioneer soil survey of the Thompson River valley. When completed, one or more reports will be published. In the meantime, this interim report will serve the need of soils information in the Eagle Valley map-area.

Field work began in July and was completed in August, 1963. The field sheets consisted of 9 x 9 inch air photos, scale two inches to a mile. A map, "Soil Map of Eagle River Valley, Sicamous to Three Valley Lake, scale two inches to a mile", was prepared. Hand tinted copies are supplied to government agencies, but others must obtain the prints at nominal cost from the Department of Agriculture, Victoria, and do their own tinting.

This report contains detailed descriptions of all the soils, and limited comments as to the land use of each one. The data in Table 4 includes a classification of the soils according to suitability for irrigation (13). Laboratory analyses of most of the soils, climatic data (5), and a glossary of technical and other terms used in this report are appended.

HOW TO USE A SOIL SURVEY REPORT

Farmers who have lived in a locality for a long time know the soil distinctions on their farms and on the farms of their immediate neighbors. However, unless they can refer to a soil survey report they cannot compare their soils with those on experimental stations and on other parts of the district where, perhaps, higher yields than those they obtain are reported.

The similarities and differences among soils can be studied after a soil map has been made. When comparisons are possible, new techniques that have proved successful can be transferred to the same soil elsewhere or to closely related soils, with the least chance of failure.

To determine the nature of the soils on any farm or other land, it should be located on the soil map. Each kind of soil is marked on the map by a distinctive color and a symbol; i.e. all soils with the same color and symbol are of the same kind. To find the name of a soil so marked, refer to the map legend. If SQsil means Solsqua silt loam, there will be a description of this soil in the report, including its land use.

If a general idea of the whole area is wanted, read the soil descriptions that come under the section, "Descriptions of Soils". Then study the soil map and notice that different groups of soils tend to occur in different localities. These groupings are likely to be associated with differences in the type of farming or land use.

A newcomer seeking a farm also wants climatic information and data on schools, highways, railroads, electric services, water supplies, and population. A brief statement about these is given in the section, "Description of the Area".

The colors on the soil map are to distinguish the soils from one another, and to show the extent of each soil area. Boundaries between soils vary in width, and generally include a zone with some of the characteristics mixed. Within most soil areas there often are areas occupied by other soils, which are too small to be separated, or are so intermixed as to be inseparable. Where this occurs the areas are often mapped as a "complex" of two or more different soils.

DESCRIPTION OF THE AREA

LOCATION AND EXTENT

The surveyed area covers the sides and bottom of the Eagle Valley between Sicamous and Three Valley Lake, a distance of 30 miles. Parts of included tributary valleys are as follows: Craigellachie Creek valley, three miles, Perry River valley, $1\frac{1}{2}$ miles, Wap Creek valley from Three Valley Lake to Wap Lake, six miles.

The Eagle River valley varies from $1\frac{1}{2}$ at Malakwa to $\frac{1}{4}$ mile wide near Three Valley Lake. At Sicamous the delta between the Shuswap and Mara lakes is about $2\frac{1}{2}$ miles in width. The mapped section of the Craigellachie Creek valley is $1\frac{1}{4}$ at the lower and an eighth mile wide in the upper part. Similarly, the Perry River valley varies from $\frac{1}{2}$ to an eighth mile, and the Wap Creek valley from $\frac{1}{4}$ to three eights of a mile in width. The elevations vary from 2,700 feet at the upper limit of soil classification in the Craigellachie Valley to 1,140 feet at Sicamous.

The surveyed area occupies 16,340 acres, of which 9,904 are cultivated or potentially arable and 6,436 are nonarable.

COMMUNITY FACILITIES, POPULATION, TRANSPORTATION AND COMMUNICATIONS

The first water licence was issued in 1905 to the C. P. R. Since then numerous licences for domestic water and by logging companies have been taken out, but only a few have been for irrigation. In 1963 eight licences comprising a total of 218.3 acre-feet to irrigate 116.8 acres were on record (6). Domestic water is obtained from wells, creeks and the Eagle River. In 1964 a domestic water system was installed at Sicamous.

Sicamous is the centre of population in the Eagle Valley. Malakwa is a hamlet about 14 miles east of Sicamous. In addition, there are six railway sidings in the mapped area: Solsqua, Cambie, Craigellachie, Taft, Endiver, and Three Valley.

Sicamous and other parts of the mapped area began a rapid expansion after completion of the Rogers Pass Highway. In the general area there are 13 motels, several trailer courts, 10 service stations, four cafes, three grocery stores, a drug store, a department store, a hardware, and a laundry. There is a credit union office and a branch of the Bank of Montreal. A doctor and ambulance serves the district, but at present the nearest hospital is at Salmon Arm. There are consolidated schools at Sicamous and Malakwa, equipped with school bus service. Law enforcement is by the R.C.M.P. There is a B. C. Fruit Board check station east of Sicamous and a Forest Ranger Station in the village.

Sicamous is unincorporated, with a population of about 700. In 1963 eligible voters amounted to 333 at the Sicamous polling station (17). In addition, 147 people were eligible to vote at Malakwa, 77 at Solsqua, 34 at Cambie, 33 at Craigellachie, and 15 at Taft.

Five sawmills in the valley ship many carloads of lumber each year. A new industry started in 1964 consists of a marble crushing plant.

The golden spike, connecting the main line of the C. P. R. east and west, was driven at Craigellachie in 1885. There is daily passenger train service and a bus line. Highway No. 1 provides access to Vancouver and Calgary. A secondary gravelled road follows the north side of the Eagle River from Sicamous to Cambie Bridge. There are logging roads up the side valleys. The valley is served by the B. C. Hydro and Power Authority and by the Okanagan Telephone Company.

CLIMATE

Easterly movements of damp air from the Pacific Ocean dominate the climate. The general distribution of precipitation is affected by the north-south trend of the mountain systems, which act as barriers. The heaviest falls of rain and snow are on the western slopes. East-west gaps in the mountains that lead from the western slopes are also humid. Thus, there is a flow of damp air from Shuswap Lake that moves eastward in the Eagle Valley.

In winter, low pressure systems cross the country from October to April, causing cloud cover and precipitation. These systems may come one after another with scarcely a clear day between, and may persist for weeks or even months. However, occasionally the pattern may be interrupted for a few days to a week or more when continental arctic air covers the region. Such interruptions may begin with strong winds, which soon clear the atmosphere of clouds. The low temperatures at such times depend on the southerly penetration of the cold front, which buries the area to a small or great extent in the cold air mass.

The summer climate is influenced more commonly than in winter by high pressure systems that originate over the Pacific Ocean and move inland. These highs last from a few days to several weeks and bring warm, dry weather periodically punctuated by rain showers.

Temperature

Sicamous has the only temperature station in the surveyed area, and this has operated since 1955. Average monthly temperatures and the average annual mean, 1955 to 1962, are as follows:

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
25	28	36	46	56	63	69	66	57	46	34	29	46

For the years of record, the absolute maximum and minimum temperatures, in degrees F. at Sicamous, were as follows:

	1955	1956	1957	1958	1959	1960	1961	1962
Maximum	93	96	87	93	95	97	97	93
Minimum	-10	-11	-21	10	-13	- 3	8	13

Precipitation

The amount of precipitation depends on elevation; the valley receives less than the surrounding mountains. There is an increase of precipitation from Sicamous to Three Valley Lake and the Wap Creek valley.

In winter the amount of snow varies widely over the years. At Malakwa, where the record goes back to 1924, the variation lies between a high of 149.9 inches in 1935 and a low of 42.7 in 1928. The average is 108.6 inches. At Sicamous, where the record starts in 1955, the high was 105.6 inches in 1956 and the low 47.6 in 1961.

In cleared and cultivated land there is a certain carry-over of snowmelt moisture into the growing season, particularly in the heavier textured soils. (It is doubtful if the light textured ones have any carry-over benefit.) Aside from this, most of the non-irrigated agriculture must depend on erratic rainfall from May to August inclusive. For these months the variation at Malakwa since 1924 is between 3.90 and 14.27 inches. At Sicamous since 1955 the variation was from 6.39 to 10.53 inches. These figures show that irrigation would give a crop yield response, particularly in the light soils. The records are detailed in Appendix Tables A and B.

Appendix Table A gives the data for monthly and average precipitation, snowfall and May to August rainfall, including highs and lows, at Malakwa from 1924 to 1962. The average annual precipitation for Malakwa is 30.40 inches; the greater part comes as snowfall in winter and as rainfall in late fall and early spring. However, the significant months for agriculture are May to August inclusive, and the average for these months is 8.25 inches. Seventeen of the 39 years of record have preceipitation above average, 10 of them between 1952 and 1962. This indicates somewhat higher rainfall in the past decade than in the three previous ones for the May-August period.

Appendix Table B presents data for monthly and average precipitation at Sicamous, 1955 to 1962. The average annual precipitation for the period is 25.16 inches, and rainfall from May to August inclusive average 8.37 inches.

Records for hours of sunshine and the frost-free period are not available.

AGRICULTURE

At the time of the survey (1963), farming was confined to the Eagle Valley, in the area between Sicamous and Perry River. In the farmed sections the forest consists chiefly of a heavy regrowth which is expensive to clear. Most of the farmed acreage has been cleared since World War II. Farming is chiefly for hay and cereals, used chiefly to feed beef and dairy cattle. Beef cattle are ranged in the surrounding mountains. A few farmers have dairy cows for their own milk, cream and butter.

Agriculture is confined chiefly to small farms. A survey by the District Agriculturist, Salmon Arm, in co-operation with the Provincial Assessor in 1961 listed 140 farm properties having a total of 8,667 acres. The farms of each size was as follows:

Table 1 - FARM ACREAGE AND NUMBER OF FARMS, 1961

Acres per Farm	Number of Farms
4.5 - 20	13
20.1 - 40	52
40.1 - 60	24
60.1 - 80	21
80.1 - 100	4
100.1 - 120	8
120.1 - 140	8
140.1 - 160	6
160.1 - 200	2
200.1 - 245	2

The average farm size is less than 40 acres. Only four farms are more than 160 acres. The survey revealed that 37 of the 140 farms were held by absentee owners.

The moisture requirements of soils vary with the texture of the soil profile. Though the finer textured profiles have minor moisture deficiency, irrigation is definitely required for the coarser ones. For example, the moisture deficiency of two farmed soils over and above rainfall, May to August inclusive is as follows:

Table 2 - WATER REQUIREMENTS OF TWO EAGLE VALLEY SOILS (19)

	Irrigation Interval Days	Duty of Water* Inches	Average Rainfall Malakwa, May-Aug. Inches (39 Years)	Moisture Deficiency Inches
Yard sandy loam	15	21	8.25	12.75
Solsqua silt loam	30	12	8.25	3.75

*Annual Requirement in inches of water for sprinkler irrigation.

The above table indicates that a sandy loam profile has a moisture deficiency about nine inches greater than a silt loam. Both soils are dry farmed. However, it is evident that the silt loam will produce the greater crop. The figures refer to tree fruits but they also apply to alfalfa.

DRAINAGE

The Eagle River begins between Victor Lake and Eagle Pass, as a small stream in a swamp at about 1,800 feet elevation. It flows west in the Eagle Valley bottom into Three Valley Lake and finally into Shuswap Lake at Sicamous, at about 1,142 feet (high water). The total length of the river is about 36 miles.

Above Taft (elevation 1,276 feet) the stream is narrow and the flow is fast. In the first 15 miles it drops about 35 feet per mile. From Taft to Sicamous (21 miles), the river meanders and the grade is only about 6.4 feet per mile.

The Eagle River has 38 tributaries and a drainage basin of about 460 square miles. The largest tributaries are South Pass, Crazy, Craigellachie, and Yard creeks, and the Perry River. Some of the smaller creeks are dry after the freshet, or run awhile after rains. There are four lakes: Willis, Griffin, Three Valley, and Victor.

South Pass Creek drains about 2½ miles of Wap Valley. The remainder of the mapped area in this valley to the south, amounting to 3½ miles, is drained by Wap Creek. This creek flows into Wap Lake, and from there to Mabel Lake.

Eagle River flow information is scanty. There are year records for 1914 and 1955-56, and May-September records for 1955 and 1956, at Malakwa. These indicate a probable maximum annual flow of about one million acre-feet, with a minimum around half that amount. The limited information is tabulated as follows (18):

	Cubic Feet Per Second			Runoff	
	Maximum per Day	Minimum per Day	Average per Day	Inches on Drainage Area	Total in Acre-feet
1914, Jan. 1- Dec. 31	6,800 (June 18)	225 (March 8)	1,332	42.7	975,300*
Oct. 1, 1955,- Sept. 30, 1956	7,130 (May 21)	170 (Jan. 26)	1,140	36.9	827,500

	Cubic Feet Per Second			Runoff	
	Maximum per Day	Minimum per Day	Average per Day	Inches on Drainage Area	Total in Acre-feet
Summer Flows					
1955, May-Sept.	8,480 (June 23)	356 (Sept. 24)	2,520	34.13	763,800 (May-Sept.)
1956, May-Sept.	7,130 (May 21)	420 (Sept. 7)	1,988	26.92	603,440** (May-Sept.)

**Estimated for May and December
**72.9 percent of total for Oct. 1, 1955, to Sept. 30, 1956

ORIGIN OF SOIL FORMING MATERIALS

In the Craigellachie Creek valley remnants of deltas in the form of outwash terraces have a maximum elevation of about 2,700 feet. From this level to about 1,900 feet the deposits are kettled, indicating glacier ice nearby and buried in them when they were formed. It appears that these deposits were laid against a declining valley glacier, and that ice-margin streams took drainage between the glacier and the mountain. Such streams left kames at levels corresponding to the delta remnants.

Below 1,900 feet there is another series of delta remnants and kames, which are not kettled, and which have lower elevations of about 1,450 feet. The Wap Creek delta at Three Valley Lake has a maximum elevation of about 1,900 feet and no kettles were found. The deltas and kames are composed of stratified gravel and sands, which were mapped as the Wap and Taft series.

From 1,450 feet elevation to within a few feet of the present level of the Eagle River, there are a third series of outwash terraces, possibly glacio-fulvial, from which the Malakwa and Shuswap series are derived.

The gravelly and sandy outwash below 1,600 feet between Malakwa and Sicamous is probably younger than a silt deposit that filled the valley to about 1,600 feet elevation between these two points, and since has been almost completely eroded away. The silt formation is identified by remnants of a silty, glaciolacustrine terrace on the south side of the Eagle Valley near Malakwa, and on the north side near Sicamous. The elevation of this silt compares with that of similar silt and clay deposits in the Okanagan Valley.

This indicates that a glacial lake in the Okanagan may have extended into the Eagle Valley, with possible drainage into the Columbia River. The soils derived from these silts were mapped as members of the Tappen series. In places, slopewash has spread a thin layer of gravelly and sandy material over the stratified silts, and the resulting soils were classified as the Syphon series.

The tributary streams downcut through their higher deltaic deposits as the valley ice decayed or lake levels declined, finally to lay fans on the valley bottom near the level of present runoff. The fans tend to cross the Eagle Valley, forming low dams, which cause the river to meander around the fan aprons. Fans also cover parts of terraces, glacial till deposits, and to a minor extent the glaciolacustrine silts. They vary in their texture and drainage, and thus were separated into four series: Grindrod, White, Hupel, and Sitkum soils.

The stretches between fans were filled by the finer material in the stream loads. The general result was to flatten the river grade between Taft and Yard Creek. From Cambie to Sicamous the appearance of the bottomlands suggest that Shuswap Lake occupied the area, and a delta was built outward as the lake lost surface elevation. Yard Creek marks the beginning of deltaic deposits that gradually filled the valley to present runoff elevations, and to the present shoreline of Shuswap Lake at Sicamous. The river bottom soils between fans, and the deltaic deposits below Yard Creek, have a wide variation of texture and drainage. They are the soil-forming deposits from which the Yard, Mabel, Rumball, Duteau, Legerwood, Gardom, and Solsqua soils are derived.

Very poorly drained areas accumulated organic matter composed chiefly of sedges and swamp-forest litter. This was mapped as Okanagan Muck.

SOIL MAPPING AND CLASSIFICATION

Field Methods

The soils of the Eagle Valley were mapped on a reconnaissance scale of 2 inches to a mile. Air photos were used as field sheets, and the classification data were plotted upon them.

Test pits, road cuts, and other excavations were used to examine soil profiles, to identify them, to sample them for laboratory analyses, and to obtain profile descriptions. The profiles were studied to determine texture, structure, consistence, permeability, drainage, and other observable features in the environment of each soil-forming deposit.

Soil boundaries were found and established by bisecting them on roads and by traverses across fields and through bush. Soil colors were identified by use of the Munsell Color System (10).

Soil Classification

Soils develop from soil-forming deposits in response to the local environment. The kind of soil thus formed depends on the nature of the parent material, the length of time the genetic process has been operative, and the intensity of weathering. The speed of weathering is related to the amount of precipitation, the temperature, texture, topography, drainage, and other environmental factors. The soil survey identifies the product and separates the different soils by means of a system of classification.

On the basis of age and origin, the soils of the Eagle Valley range from early post-glacial (some thousands of years old), to more or less recent (at most only a few hundred years old). The older ones are derived from glacial outwash, glaciolacustrine, and the older fan deposits. These have been assigned to the Gray Wooded, and Podzol soil groups. The younger ones are Brown Wooded, Regosolic, Gleysolic, and Organic soils.

Table 3 gives the relationship of the soil-forming deposits to soil subgroups and series. In the Eagle Valley the soils developed under a relatively dense forest. The classification grades the soils from Regosols (the least weathered) to Podzols (the most weathered). The soils influenced by water tables are the Gleysols and Muck soils.

The basic mapping unit is the soil series. A soil series consists of a group of related soils derived from similar parent materials having similar drainage, topography and profile characteristics except for surface texture. Areas having variable surface textures, but otherwise the same, are distinguished as subdivisions of a soil series, called soil types. Areas of a series in which the surface texture does not vary are also mapped as soil types. Soil types are distinguished by the name of the series (e.g. Malakwa) and the texture of the surface soil (e.g. gravelly sandy loam), the full name of the soil being Malakwa gravelly sandy loam. The series names usually are place names in the locality in which a soil series was originally classified.

Phases of a soil series may also be distinguished. These are based on variations within a series of topography, stoniness, drainage, depth of profile or other features that may affect land use.

In some cases it is not feasible to separate two or more soil series. Such areas are mapped as soil complexes. Where two or more

Table 3 - CLASSIFICATION OF SOILS AND PARENT MATERIALS IN THE EAGLE RIVER VALLEY

Parent Materials	Orthic Regosol	Gleyed Orthic Regosol	Rego Gleysol	Peaty Gleysol	Orthic Brown Wooded	Orthic Gray Wooded	Brunisolic Gray Wooded	Minimal Podzol	Orthic Podzol	Muck Soils
Gravelly Outwash & Deltaic Deposits								Malakwa	Wap	
Sandy Outwash & Deltaic Deposits								Shuswap	Taft	
Glaciolacustrine Deposits						Tappen				
Alluvial-Colluvial Fan Deposits	Grindrod				White			Hupel	Sitkum	
Slopewash over Glaciolacustrine Deposits							Syphon			
Alluvial River Deposits	Yard	Mabel Rumball	Duteau Legerwood	Gardom		Solsqua				
Organic Deposits										Okanagan

soil series have been described separately, the name of the complex consists of the names of the series of which it is composed. Such names are hyphenated (e.g. Malakwa-Shuswap complex); the name of the series that occupies the major acreage comes first and the other names follow in the same order.

The soil series are classed in subgroups according to the pedologic development which signifies their genetic relationship to one another. The mineral soil subgroups in the Eagle Valley (Table 3) are Orthic Regosol, Gleyed Orthic Regosol, Rego Gleysol, Peaty Gleysol, Orthic Brown Wooded, Orthic Gray Wooded, Brunisolic Gray Wooded, Minimal Podzol, and Orthic Podzol soils. The Muck soils are an additional subgroup that do not have a place in the pedologic arrangement. Short descriptions of the observable characteristics of the subgroups head more detailed soil descriptions in this report.

DESCRIPTIONS OF SOILS

REGOSOL SOILS

Regosols are mineral soils which lack observable horizons or have only a very weakly developed Ah horizon. An L-H horizon less than 12 inches thick may be present.

In the Eagle Valley the Regosol soils occur on recently deposited materials, with a cover of mixed deciduous-coniferous forest. The subgroups are Orthic and Gleyed Orthic Regosols.

Orthic Regosol Soils

This subgroup consists of mineral soils having little or no profile development. The soils lack observable horizons or have very weakly developed Ah horizons. Under forest an L-H horizon up to two inches thick may be present. The profile is not visibly gleyed.

In the mapped area these soils occur as the Grindrod series on alluvial-colluvial fan deposits, and the Yard series, which is derived from river alluvium.

Gleyed Orthic Regosol Soils

The Gleyed subgroup is composed of mineral soils similar to the Orthic subgroup; the distinction between the two subgroups consists of faint mottling in the C horizons.

The representatives in the surveyed area are the Mabel complex and the Rumball series, both derived from river alluvium.

Orthic Regosol Soils

GRINDROD SERIES

These soils occur on alluvial-colluvial fans throughout the surveyed area. The topography varies from gently to steeply sloping; slopes are from five to 25 percent. Elevations are between 1,175 and 1,800 feet.

The parent material is composed of creek deposits in the form of fans. The steeper and most stony parts of each fan are near the apex, and from there the slopes become gentle toward the fan apron. This trend is accompanied by gradation to finer textures. The following soils were mapped:

Grindrod gravelly sand	114 acres
Grindrod sand to sandy loam	95 "
Grindrod gravelly loamy sand	30 "
Grindrod loamy sand to sandy loam	178 "
Grindrod gravelly sandy loam	27 "
Grindrod sandy loam	48 "
Grindrod fine sandy loam	54 "
Grindrod-Duteau sandy loam complex	41 "

The Orthic Regosol Grindrod soils are rapidly to moderately well drained, with areas of seepage near creeks and fan margins. The native vegetation consists of a mixed coniferous-deciduous forest composed of spruce, cedar, cottonwood, and birch, with a medium dense undercover of thimbleberry, bunchberry, sarsaparilla, twin flower, and others. A description of the loamy sand profile follows:

Horizon	Depth Inches	Description
L-H	1 - 0	Forest litter, well decomposed in the lower part.
C1	0 - 4	Grayish-brown (10YR 5/2, moist) loamy sand. Single-grained. Loose when moist. Roots common. pH 6.7. Clear boundary:
C2	4 -12	Brown (10YR 5/3, moist) gravelly sand. Single-grained. Scattered cobbles. Roots common. pH 7.0. Clear boundary:
C3	12 +	Gravelly coarse sand containing many cobbles and stones. pH 7.2.

Land Use

At the time of the survey (1963) small acreages of the Grindrod soils were cultivated for forage crops in the area between Sicamous and Perry River. The greater part of the acreage was occupied by forest.

These are limited use soils, due to coarse textures and variable stoniness. Most of the acreage ranges from poor to doubtful for agriculture. The most arable areas are suitable only for hay and pasture.

About 144 acres are nonarable. Of the soils suitable for irrigation, 54 acres are third, 219 fourth, and 170 are fifth class land.

YARD SERIES

This series occurs in the Eagle River Valley between Sicamous and Malakwa. The topography is variable from gently undulating to undulating; there are minor inclusions of short, choppy to gently rolling slopes. The elevations are from 1,140 to 1,200 feet.

The parent material is composed of coarse textured alluvium in the meander belt or between meanders of the river. The deposits consist of gravel-free, braided sands capped by from six to 18 inches of loamy sand to fine sandy loam. Sandy loam, the most common texture, was the only one separated. The series was mapped separately and with others as follows:

Yard sandy loam	485	acres
Yard sandy loam-Duteau sandy loam complex	9	"
Yard sandy loam-Rumball silt loam complex	286	"
Yard sandy loam-Solsqua silt loam complex	49	"

The Yard soils are well-drained Orthic Regosols. They are not subject to flooding. The subsoil drains freely when the river returns to normal flow after the freshet. The native vegetation consists of cedar, cottonwood, birch, and alder, with a lower story of thimbleberry, snowberry, spirea, salal, and herbs. An undisturbed profile was given the following description:

Horizon	Depth Inches	Description
L-F	1 - 0	Forest litter. Decomposed in the lower part. pH 6.5.
$Ah\bar{j}$	0 - 7½	Light brownish gray to light yellowish brown (2.5Y 5/3, dry) or dark grayish brown (10YR 4/2, moist) sandy loam. Weak medium subangular blocky structure. Very friable when moist. Roots common. pH 6.5. Clear boundary:

Horizon	Depth Inches	Description
AC	$7\frac{1}{2}$-$12\frac{1}{2}$	Light brownish gray (2.5Y 6/2, dry) or grayish brown to dark grayish brown (10YR 4.5/2, moist) loamy fine sand. Weak medium subangular blocky structure. Very friable when moist. Roots common. pH 6.2. Clear boundary:
C1	$12\frac{1}{2}$-24	Light brownish gray (2.5Y 6/2, dry) or grayish-brown to dark grayish brown (2.5Y 4.5/2, moist) loamy sand or sand. Single-grained. Loose when moist. Occasional roots. pH 6.8. Diffuse boundary:
C2	24 -36	Light brownish gray (2.5Y 6/2, dry) or dark grayish brown (2.5Y 4/2, moist) loamy sand or sand. Single-grained. Loose when moist. Occasional roots. pH 6.8. Diffuse boundary:
C3	36 +	Light brownish gray (2.5Y 6/2, dry) or dark grayish brown (2.5Y 4/2, moist) sand. Single-grained. Loose when moist. Occasional roots. pH 6.9.

Land Use

Scattered areas of the Yard soils are used for cereal and forage crops along the river between meanders. Most of the acreage was in forest at the time of the survey (1963). Clearing is expensive.

The cultivated areas are dry farmed. Fair yields are obtained in growing seasons with above average or well distributed rainfall. The use of sprinkler irrigation as required would increase the yields of these sandy soils.

According to suitability for irrigation, there are 485 acres of third class Yard sandy loam, nine of fourth class Yard-Duteau sandy loam complex, 286 of third class Yard sandy loam-Rumball silt loam complex, and 49 of Yard sandy loam-Solsqua silt loam complex.

Gleyed Orthic Regosol Soils

MABEL COMPLEX

The Mabel soils are near the mouth of the Eagle River and they also occupy scattered areas between Yard Creek and Perry River, at elevations between 1,140 and 1,250 feet. On the river bottoms the topography varies from gently undulating to undulating. It is gently to moderately sloping at the foot of the Yard Creek fan. In the river bottom areas there are braided surfaces, oxbows and abandoned channels.

The parent material consists of sandy and silty alluvium. The Mabel complex is subject to inundation during the annual freshet, and thereafter to a high water table until the river flow returns to normal. Surface textures are from loamy sand to silt loam, with lenses or strata of different texture in the profile. There are occasional ridges of gravel in the river bottom areas, and gravel is common near the Yard Creek fan. Small deposits of peat or muck occur in the bottoms of oxbows and abandoned stream channels.

Of the Mabel complex 159 acres are arable and 455 nonarable in a total of 614. In addition 285 acres were mapped as a Mabel-Duteau sandy loam complex, of which 218 acres are arable and 67 nonarable.

The imperfectly drained Mabel soils are Gleyed Orthic Regosols. The native vegetation is composed of cedar, cottonwood, birch, red-osier dogwood, and a light ground cover of herbs and grasses. A description of the loamy sand profile follows:

Horizon	Depth Inches	Description
L-H	$\frac{1}{4}$- 0	A thin litter, mostly deciduous leaves, and little or no decomposition.
C1	0 - 4	Dark grayish brown (10YR 4/2, moist) loamy sand. Single-grained. Loose when moist. Roots abundant. A recently deposited horizon. pH 6.3. Abrupt boundary:
C$\bar{g}$j-H	4 -10	Dark grayish brown (2.5Y 4/2, moist) loamy sand to loam. A few faint mottles. Single-grained to massive. Loose to very friable when moist. Roots common. pH 6.2. Abrupt boundary:
Cg	10 +	Dark grayish brown (2.5Y 4/2, moist) loamy sand or sandy loam, containing strata of finer texture. Common, faint mottles. Single-grained to massive. Loose to very friable when moist. Occasional roots to 36 inches. pH 6.3.

Land Use

These soils are of doubtful value for agriculture, owing to annual inundation. At the time of the survey (1963) all of the acreage was forested. After clearing, dyking and drainage would be necessary before normal farm practice could be undertaken.

When dyked, drained and otherwise reclaimed, the suitability for irrigation would be 159 acres of fifth class Mabel complex, and 218 acres of fifth class Mabel-Duteau sandy loam complex.

RUMBALL SERIES

The Rumball soils occur on alluvium in the bottom of the Eagle Valley between Sicamous and Perry River. The topography is from gently undulating to undulating and the elevations lie between 1,140 and 1,250 feet.

The parent material is composed of medium to moderately fine textured river deposits of more or less recent age. The surface textures vary from silt loam to sandy loam; silt loam occupies the greater acreage. Subsoil horizons vary in thickness and texture. Sands are found at depths below two or three feet. In the valley between Solsqua and Sicamous, diatomatceous earth was seen in scattered areas near the surface, and lenses of volcanic ash were observed at depths. Gravel strata occur below five feet from the surface. The following soils were mapped:

Rumball silt loam	30	acres
Rumball silt loam-Yard sandy loam complex	46	"
Rumball silt loam-Duteau sandy loam-Mabel complex	506	"

The Rumball soils are imperfectly drained Gleyed Orthic Regosols, with small unmappable areas of Gleyed Mull Regosols included. The vegetation consists of a fairly heavy forest of cedar, cottonwood, birch, and alder, with a shrub layer of thimbleberry, salal and spirea. The herbaceous growth includes ferns and wild flowers. A cultivated soil profile of the silt loam type was described as follows:

Horizon	Depth Inches	Description
Ap	0 - 6	Gray (10YR 5/1, dry) or dark-gray to very dark gray (10YR 3.5/1, moist) silt loam. Weak, medium subangular blocky breaking to granular structure. Slightly hard when dry. Friable when moist. Roots abundant. pH 5.8. Abrupt boundary:
IICg	6 -15	Brown to yellowish-brown (10YR 5/3.5, dry) or brown to dark-brown (10YR 4/3, moist) loamy sand. Single-grained. Common, distinct mottles. Roots common. pH 6.4. Abrupt boundary:

Horizon	Depth Inches	Description
Cg1	15 -24	Light-gray (10YR 6/1, dry) or dark-gray (10YR 4/1, moist) silty clay loam. Moderate, fine, subangular blocky structure. Common, distinct mottles. Slightly firm when moist. Roots common. pH 5.6. Abrupt boundary:
Cg2	24 +	Grayish-brown (10YR 5/2, dry) or dark grayish brown (10YR 4/2, moist) sandy clay loam. Massive. Common, faint mottles. Friable when moist. Occasional roots in the upper part. pH 6.0.

Land Use

Small areas of the Rumball soils are cleared and under cultivation. The greater acreage was forested at the time of the survey (1963). The areas under cultivation produce hay and pasture. Clovers do better than alfalfa, owing to a fluctuating water table, which rises and falls with the river levels.

Of the soils suitable for irrigation, there are 30 acres of second class Rumball silt loam, 46 of fourth class Rumball silt loam-Yard sandy loam complex, and 506 of fifth class Rumball silt loam-Duteau sandy loam-Mabel complex.

GLEYSOL SOILS

These are poorly to very poorly drained soils, that developed under deciduous trees, shrubs and sedges, or they would produce this type of vegetation if left undisturbed.

Under natural conditions the mineral soil may be overlain by organic horizons less than 12 inches thick or a dark colored mineral horizon up to three inches thick. Cultivated land has a brown to grayish brown plow layer, underlain by a gleyed horizon or horizons that may or may not have weakly developed eluvial or illuvial subhorizons. The gleyed horizons are grayish, and may be mottled.

In the surveyed area two subgroups of Gleysol soils were found. These are Rego Gleysol and Peaty Gleysol soils.

Rego Gleysol Soils

These soils may have an Ah horizon up to three inches thick or an L-H horizon of organic matter up to six inches thick. Such horizons are underlain abruptly by a Gleyed Cg horizon, which may be mottled.

The Rego Gleysol soils developed under swamp or swamp-forest vegetation, with poor to very poor drainage. In the Eagle Valley this subgroup is represented by the Duteau and Legerwood series.

Peaty Gleysol Soils

This subgroup is characterized by an L-H horizon from six to 12 inches thick, beneath which is a gleyed Cg horizon. An Ah horizon less than three inches thick may be present beneath the L-H horizon. In the surveyed area the Peaty Gleysol soils are represented by the Gardom series.

Rego Gleysol Soils

DUTEAU SERIES

There are scattered areas of the Duteau soils in the Eagle Valley between Sicamous and Perry River. The topography varies from gently undulating to undulating on the river bottoms, to gently and moderately sloping on fan aprons. The elevations are from 1,140 to 1,250 feet.

The parent material is composed of sandy Eagle River alluvium and some fan aprons under the influence of a fluctuating water table. The soil profile is usually sandy, or it may have strata of variable textures. Gravel and small cobbles occur in the fan deposits and also in the river alluvium. Surface textures vary from loamy sand to fine sandy loam, sandy loam being the most common. The soils were mapped as follows:

Duteau sandy loam	140 acres
Duteau sandy loam-Legerwood silt loam	90 "

The poorly to very poorly drained Duteau soils are Rego Gleysols. The native vegetation is composed chiefly of cottonwood, birch, alder, willow, and some cedar. Open or cleared areas have a heavy growth of sedges. A Duteau sandy loam profile was given the following description:

Horizon	Depth Inches	Description
Cgj	0 - 5	Dark grayish brown (10YR 4/2, moist) sandy loam. Massive. A few faint, strong-brown (7.5YR 5/6, moist) mottles. Roots common. pH 6.4. Clear boundary:

Horizon	Depth Inches	Description
Cg	5 -10	Grayish-brown (10YR 5/2, moist) sandy loam. Massive. Many distinct to prominent dark-brown or strong-brown (7.5YR 4/4 - 5/6, moist) mottles. Scattered gravel. Roots common. pH 6.7. Clear boundary:
IICg	10 -20	Light brownish gray (10YR 6/2, moist) gravelly loamy sand. Single-grained. Many distinct to prominent dark-brown (7.5YR 4/4, moist) to reddish-yellow (5YR 6/6, moist) mottles. Scattered gravel. Occasional roots. pH 6.8. Gradual boundary:
IIICg	20 +	Light brownish gray (10YR 6/2, moist) or pale-olive (5Y 6/3, moist) gravelly sand. pH 6.8.

Land Use

At the time of the survey (1963) small areas of Duteau soils, once cleared, were slowly reverting to sedges. Most of the acreage was under light forest cover.

These are poor to doubtful soils for agriculture. The water table is high most of the growing season. Drainage is required for farming. Water-tolerant forage or pasture grasses are the only ones likely to survive.

When drained to adequate depth, the soils could be irrigated. According to the classification as to suitability for irrigation under these conditions, there are 22 acres of fourth and 118 of fifth class Duteau sandy loam, and 90 of fifth class Duteau sandy loam-Legerwood silt loam complex.

LEGERWOOD SERIES

The Legerwood soils occupy parts of the valley bottom from Cambie Bridge to Perry River. One large area occurs as a diatomaceous earth phase near Sicamous. The topography is gently undulating to undulating. The elevations lie between 1,140 and 1,250 feet.

The parent material is composed of medium to moderately fine textured river alluvium which overlies sands at depths of from 1½ to five feet. Commonly there is an overlay with a higher content of silt and clay than the subsoil. Stratification occurs at depths. The surface textures vary from fine sandy loam to silty clay loam; silt loam is the most common. In an area near Sicamous, diatomaceous earth occurs at and near the surface. The following soils were mapped:

Legerwood silt loam	355 acres
Legerwood silt loam, diatomaceous earth phase	257 "
Legerwood silt loam-Duteau sandy loam-Mabel complex	130 "

The Legerwood soils are above the levels of the annual freshet, and receive little or no flooding. In the Cambie Bridge-Perry River section, creek fans dam the valley bottom and restrict the flow in the freshet season. This is the cause of a high water table. The resulting poor drainage has developed these soils as Rego Gleysols.

In the diatomaceous earth phase near Sicamous, the soils occupy what were backwater areas near the mountain, and drainage was poor. In this area a ditch has improved drainage and the productivity of the soils.

The native vegetation consists mainly of deciduous trees and shrubs, including cottonwood, birch, alder, and willow. Semi-open and uncultivated, cleared areas produce a mixture of wild grasses, buttercup and sedges. A cultivated profile in a hayfield was described as follows:

Horizon	Depth Inches	Description
Ap	0 - 8	Grayish-brown (10YR 5/2, dry) or brown to dark-brown (10YR 4/3, moist) silt loam. Moderate, medium to coarse subangular blocky structure. A few fine, faint dark yellowish brown (10YR 3/4 - 4/4, moist) mottles. Firm when moist. Roots abundant. pH 5.3. Abrupt boundary:
Cg1	8 -17	Light brownish gray (2.5Y 6/2, dry) or dark grayish brown (2.5Y 4/2, moist) silt loam. Moderate, coarse subangular blocky structure. Common, medium distinct dark yellowish brown (10YR 3/4 - 4/4, moist) mottles. Firm when moist. Occasional roots. pH 5.9. Abrupt boundary:
Cg2	17 -29	Grayish-brown to light brownish gray (2.5Y 5.5/2, dry) or olive-gray (5Y 4/2, moist) silty clay loam. Massive. A few medium, distinct dark yellowish brown (10YR 3/4 - 4/4, moist) mottles. Sticky when wet. pH 6.0. Abrupt boundary:
Cg3	29 -38	Olive-gray (5Y 4/2, moist) very fine sandy loam. Massive. Clear, common, dark yellowish brown (10YR 3/4 - 4/4, moist) mottles. Slightly sticky when wet. pH 6.1. Clear boundary:

Horizon	Depth Inches	Description
Cg4	38 -46	Olive-gray (5Y 4/2, moist) silt loam or silty clay loam. Massive. A few medium, distinct, dark yellowish brown (10YR 3/4 - 4/4, moist) mottles. Sticky when wet. pH 6.1. Clear boundary:
IICg	46 +	Olive-gray (5Y 4/2, wet) sand. Single-grained. Water below 56 inches. pH 6.1.

The organic matter in the Ap horizon is due to the incorporation of litter at the surface when the soils are cultivated.

Land Use

Suitability for agriculture of the Legerwood soils depends upon the height of the water table in the growing season, and the depth of underlying sand. Drainage is required for farming.

From Yard Creek to Perry River, small areas are cultivated for forage crops. The soils are poor to doubtful for farming, owing to a high water table during most of the growing season. Forage grasses are supplanted by wild grasses and sedges if the land is not drained.

The diatomaceous earth phase is fair for agriculture. The land has been drained and forage is produced on small cleared areas. Newly cleared and cultivated land in this phase has a white, floury appearance. The heavy forest growth makes it expensive to clear.

Suitability for irrigation of the undrained Legerwood silt loam in the Cambie Bridge to Perry River area consists of 337 acres of fourth and 18 of fifth class land. Where drainage has been provided in the diatomaceous earth phase near Sicamous the soils suitable for irrigation total 257 acres of third class land.

Peaty Gleysol Soils

GARDOM SERIES

These are a minor group of soils found only in two small areas. One, with gently undulating topography, is near Malakwa at 1,175 feet elevation. The other, moderately sloping, is at the lower edge of a fan apron near Three Valley Lake at an elevation of 1,750 feet. A total of 77 acres was classified.

The parent material is sandy alluvium near the river, subject to a high water table, and coarse textured fan deposits under the influence of creek seepage. The moisture conditions are such as to accumulate peat and muck on the surface from six to 12 inches thick. There are spots where the organic layer attains a depth up to 24 inches. The organic matter is composed chiefly of wood debris and the remains of marsh plants.

The native vegetation consists of deciduous trees and hardhack, tules, skunk cabbage, buttercup, vetch, moss, and others. A profile under native cover on sandy alluvium was given the following description:

Horizon	Depth Inches	Description
H	10 - 0	Dark reddish brown (5YR 2/2, moist) peaty muck. Roots abundant. pH 4.7. Abrupt boundary:
Cg-H	0 - 7	Dark grayish brown (10YR 4/2, moist) layers of silt loam containing organic matter and layers of organic matter. Slightly sticky when wet. Roots common. pH 5.3. Abrupt boundary:
Cg1	7 -21	Dark-brown (10YR 3/3, moist) sand or loamy sand. Single-grained. Occasional roots. pH 5.3. Abrupt boundary:
IICg	21 +	Coarse sand. Single-grained. pH 4.9.

Land Use

The mapped acreage of the Gardom soils was undeveloped for agriculture at the time of the survey (1963). For farming they are poor to doubtful because adequate drainage would be required before they could be cropped.

If drained and reclaimed to the extent where irrigation is required, the suitability for irrigation consists of 61 acres of fourth and 16 of fifth class land.

BROWN WOODED SOILS

These are well to imperfectly drained soils that developed under forest. They appear to represent a stage of soil genesis between the Regosol and Gray Wooded soil groups. Distinct eluvial and illuvial horizons are lacking. This could be due to dry climate, youth, calcareous parent material or a combination of two or more of these factors. The vegetation may be open to heavy coniferous forest. Only the Orthic subgroup was found in the surveyed area.

Orthic Brown Wooded Soils

Orthic Brown Wooded are well-drained soils characterized by pale-brown to yellowish-brown Bm or Bf horizons that show no translocation of clay or sesquioxides. There is a thin L-H horizon of forest litter at the surface.

Where the soils are deeply weathered, the Bf horizon is underlain by a Bm horizon. In other places a transitional BC horizon is usually present. In the surveyed area the representative is the White series.

WHITE SERIES

The White soils are a minor group that occur on fan deposits on the north side of the Eagle River between Solsqua and Cambie Bridge. The topography is from gently to steeply sloping and the elevations lie between 1,200 and 1,400 feet. A total of 103 acres were mapped as arable. An additional 120 acres are nonarable.

The parent material is coarse textured and calcareous. It is typical fan deposition which grades down from a steeply sloping, stony apex to coarse textured aprons of variable gravel and small cobble content, having more gentle slopes. The angular gravel and cobbles are limestone and schistose containing calcite veins. Surface textures vary from gravelly loamy sand to gravelly loam; gravelly sandy loam is the most common, and some sandy loam occurs.

The rapidly drained, Orthic Brown Wooded White soils were separated into gravelly sandy loam and sandy loam. The native vegetation consists of a light cover of Douglas fir, scattered cedar, and birch. The undercover is composed chiefly of false box, Oregon grape, waxberry, kinnikinnick, ocean spray, and pinegrass. A profile on a fan was given the following description:

Horizon	Depth Inches	Description
L-H	1 - 0	Forest litter, decomposed in the lower part. pH 6.0.
Bhf̄j	0 - 6	Dark yellowish brown (10YR 4/4, dry) or dark-brown (7.5YR 3/2, moist) gravelly sandy loam or loam. Very weak, fine to medium subangular blocky, breaking to fine granular structure. Soft when dry. Very friable when moist. Scattered gravel. Roots abundant. pH 7.1. Clear boundary:

Horizon	Depth Inches	Description
Bf̄j	6 -11	Yellowish-brown to brown (10YR 5/3.5, dry) or dark yellowish brown (10YR 3/4, moist) gravelly sandy loam or loam. Very weak, fine to medium subangular blocky, breaking to fine granular structure. Soft when dry. Very friable when moist. Scattered gravel. Roots abundant. pH 7.4. Clear boundary:
BC	11 -20	Grayish-brown to brown (10YR 5/2.5, dry) or dark-brown (10YR 3/3, moist) gravelly sandy loam. Very fine granular structure. Soft when dry. Friable when moist. Scattered gravel and cobbles. Calcareous in root channels. Roots abundant. pH 7.9. Gradual boundary:
Ck	20 -30	Grayish-brown to dark grayish brown (10YR 4.5/2, moist) gravelly sandy loam. Very fine granular structure. Slightly hard when dry. Firm when moist. Scattered gravel and cobbles. Calcareous. Roots common; root mats at 30 inches. pH 7.9. Clear boundary:
IICkC	30 +	Matrix, olive-gray (5Y 5/2, dry), light gray flecks (5Y 7/1, dry), dark-olive (5Y 3/2, moist) flecks of olive-gray (5Y 4/2, moist) clean, cemented, gravelly sand. Massive. Very hard when dry and firm when moist. Numerous gravel and cobbles. Very calcareous. Occasional roots. pH 8.2.

Land Use

A small acreage on the lower parts of three of the four fans mapped was cleared and in forage crops at the time of the survey (1963). The balance of the acreage was in forest.

Irrigation is required because of coarse profile textures and calcareous subsoils. It is doubtful if any more of the White series should be developed for cultivated agriculture.

According to suitability for irrigation, there are 89 acres of fourth class White gravelly sandy loam, and 14 of third class sandy loam.

GRAY WOODED SOILS

Gray Wooded soils develop from medium textured, calcareous parent materials in the surveyed area. Beneath a surface layer of forest litter (L-H), there is a horizon of eluviation (Ae) in turn underlain by an illuvial horizon of clay accumulation (Bt); these are the prominent features of the profile. Any other A or B horizons are transitional, and named according to the closest relationship with the one above or below. In coarse-textured profiles the Bt horizon may consist only of one or more clay layers separated by Ae horizon material. A Cca horizon may be present or absent. Two subgroups were found:

Orthic Gray Wooded Soils

These soils have a surface layer of forest litter (L-H), a light-gray Ae horizon and a grayish-brown to pale-olive Bt horizon. The Bt horizon has blocky structure. Transitional AB and BC horizons may or may not be present.

In the Eagle Valley this subgroup is represented by the Tappen and Solsqua series.

Brunisolic Gray Wooded Soils

The Brunisolic subgroup differs from the Orthic by having a brightly colored horizon in the upper part of the Ae horizon.

The representative of this subgroup is the Syphon series.

Orthic Gray Wooded Soils

TAPPEN SERIES

This minor group of soils occurs on the higher terraces northeast of Sicamous and east of Malakwa. The topography is from gently to strongly rolling. The elevations range from 1,300 to 1,600 feet. One 427 acre area was mapped as a Shuswap sandy loam-Taft sandy loam-Tappen silty clay loam complex, and another 126 acres as a Syphon sandy loam-Tappen silty clay loam complex.

The parent material consists of stratified glaciolacustrine deposits that vary from silt loam to clay. There are calcareous layers at depths below 30 inches. Surface textures vary from silt loam to light clay; silty clay loam is the most common.

Due to heavy forest cover, the Tappen series could not be separated from associated soils, with which it occurs in minor acreages. It was mapped as a minor associate with the Shuswap, Taft and Syphon series. These soils occur as follows: The lacustrine deposits are overlain to variable depths by sandy and gravelly slopewash (Syphon series), and sandy outwash (Shuswap and Taft series). The rolling topography is due to erosion of the lacustrine materials during deposition of the materials which cover them. There is seepage in areas of thin slopewash overlay.

The Orthic Gray Wooded Tappen series is moderately well-drained. The mixed coniferous-deciduous native vegetation is composed chiefly of hemlock, Douglas fir, cedar, and birch. The lower layer consists mostly of saskatoon, spirea, false box, bunchberry, queen's cup, prince's pine, aralia, twinflower, and moss. The profile was described as follows:

Horizon	Depth Inches	Description
L-H	1 - 0	Deciduous and coniferous forest litter. pH 6.5.
Ae	0 - $2\frac{1}{2}$	Light-gray (10YR 7/1, dry) or grayish-brown to dark grayish brown (10YR 4.5/2, moist) silt loam. Weak, fine platy structure. Soft when dry. Friable when moist. Roots common. pH 6.1. Abrupt boundary:
AB	$2\frac{1}{2}$- $4\frac{1}{2}$	Light-gray (10YR 7/1, dry) or grayish-brown (10YR 5/2, moist) silty clay loam. Moderate, coarse subangular blocky capping columnar structure. Peds vesicular with small remnants of Bt horizon material. Hard when dry. Firm when moist. Roots common. pH 6.3. Abrupt boundary:
Bt1	$4\frac{1}{2}$-10	Light-gray (10YR 7/2, dry) or grayish-brown to dark grayish brown (10YR 4.5/2, moist) clay. Strong, medium columnar breaking to strong, medium blocky structure. Columns have thin lighter colored coats on sides and thicker ones on tops. Very hard when dry. Firm when moist. Roots common between columns. pH 6.4. Clear boundary:
Bt2	10 -20	Light brownish gray to grayish-brown (10YR 5.5/2, dry) or dark grayish brown to very dark grayish brown (2.5Y 3.5/2, moist) clay. Strong, medium prismatic breaking to strong, coarse blocky structure. Prisms have clay skins. Very had when dry. Firm when moist. Occasional roots in vertical cleavages. pH 6.1. Clear boundary:

Horizon	Depth Inches	Description
BC	20 -24	Brown (10YR 4.5/3, dry) or olive-brown (2.5Y 4/4, moist) silty clay. Moderate, medium blocky structure. Peds have thin clay skins. Very hard when dry. Firm when moist. A few vertical cracks containing roots. pH 6.2. Clear boundary:
C1	24 -40	Pale-brown to brown (10YR 5.5/3, dry) or olive-brown (2.5Y 4/4, moist) silty clay loam. Mainly broken stratification. Some clay skins on cleavage planes. Hard when dry. Friable when moist. Occasional roots. pH 6.3. Diffuse boundary:
C2	40 +	White (10YR 8/1, dry) or gray (10YR 6/1, moist) silt loam to clay loam. Stratifications of different texture. pH 6.8.

Land Use

Small acreages of Tappen soils were cleared and in forage crops at the time of the survey (1963). Most of the acreage was in periodically logged forest having little range value.

Moisture holding capacity of the soils is good. Droughty spots occur in the areas of the complexes, where gravelly sandy loam and sandy loam overlie the finer textured parent material of the Tappen soils.

According to suitability for irrigation, the Shuswap sandy loam-Taft sandy loam-Tappen silty clay loam complex consists of 427 acres of fourth class land. The Syphon sandy loam-Tappen silty clay loam complex totals 27 acres of third and 99 acres of fourth class land.

SOLSQUA SERIES

The Solsqua soils are on terraces between Sicamous and Malakwa. The topography is gently undulating to undulating. Elevations lie between 1,140 and 1,250 feet.

The parent material consists of medium to moderately fine textured alluvium deposited by the Eagle River. This is underlain at from six to 36 inches depths, which average from 18 to 24 inches, by fine to coarse textured sands. The depth of the underlying sands varies with the topography. The sands nearest the surface are in the undulating areas, which also have the most braiding and oxbows. Near Sicamous, where the depth of the sands is generally less than 15 inches, the soils were separated as a shallow phase. The most common surface texture is silt loam; there are minor inclusions of fine sandy loam and silty clay loam. The soils were mapped as follows:

Solsqua silt loam	1,069	acres
Solsqua silt loam, shallow phase	600	"
Solsqua silt loam-Legerwood silt loam complex	50	"
Solsqua silt loam-Rumball silt loam complex	391	"
Solsqua silt loam-Yard sandy loam complex	194	"
Solsqua silt loam-Rumball silt loam-Legerwood silt loam complex	103	"
Solsqua silt loam-Yard sandy loam-Rumball silt loam complex	61	"

The moderately well to well-drained Solsqua soils, with some imperfect drainage in the shallow phase, were mapped as an Orthic Gray Wooded series. The native vegetation consists of a mixed growth of cedar, hemlock, Douglas fir, lodgepole pine, birch, cottonwood, thimbleberry, subalpine blackberry, spirea, twinflower, ferns, and others. An undisturbed soil profile was described as follows:

Horizon	Depth Inches	Description
L-H	1 - 0	Forest litter, decomposed in the lower part. Roots common. pH 5.9.
Ae1	0 - 3	Light-gray (5Y 7/2, dry) or grayish-brown (2.5Y 5/2, moist) silt loam. Moderate, medium platy structure. Firm when moist. Roots common. pH 6.4. Abrupt boundary:
Ae2	3 - 5	Light-gray (5Y 7/2, dry) or pale-olive to olive (5Y 5.5/3, moist) silt loam. Moderate, medium platy structure. Firm when moist. Roots common. pH 6.7. Clear boundary:
Bt1	5 -12	Pale-olive (5Y 6/3, dry) or dark grayish brown to olive-brown (2.5Y 4/3, moist) silty clay loam. Moderate subangular blocky structure. Very firm when moist. Roots common. pH 6.5. Gradual boundary:
Bt2	12 -18	Pale-olive (5Y 6/3, dry) or light olive brown to olive-brown (2.5Y 4.5/4, moist) silt loam or loam. Moderate subangular blocky structure. Very firm when moist. Roots common. pH 6.5. Abrupt boundary:

Horizon	Depth Inches	Description
IIC	18 -30	Light brownish gray to light yellowish brown (2.5Y 6/3, dry) or grayish-brown to dark grayish brown (2.5Y 4.5/2, moist) sandy loam. Massive. Friable when moist. Roots common. pH 6.7. Abrupt boundary:
IIIC	30 -39	Coarse sand of variegated colors. Single-grained. Loose when moist. Occasional roots. pH 6.7. Abrupt boundary:
IVC	39 +	Stratified sandy loam and sand. Occasional roots. Reaction of composite samples: pH 7.1.

A yellowish-brown Ael horizon occurs on some profiles under forest in the area between Solsqua and Cambie.

Land Use

A large acreage has been cleared and cultivated, indicating that the Solsqua are the best agricultural soils in the surveyed area. Mixed farming is practiced. Pasture, hay and cereals are grown. The cultivated acreage was dry-farmed at the time of the survey (1963). Inasmuch as little subsoil moisture is available, irrigation would increase yields, particularly in dry summers. Areas in forest are logged and pastured.

According to suitability for irrigation, there are 1,069 acres of second class Solsqua silt loam, 600 of third class Solsqua silt loam, shallow phase, 50 of second class Solsqua-Legerwood complex, 391 of third class Solsqua-Rumball complex, 139 second and 55 of third class Solsqua-Yard complex, 103 of third class Solsqua-Rumball-Legerwood complex, and 61 of third class Solsqua-Yard-Rumball complex.

Brunisolic Gray Wooded Soils

SYPHON SERIES

This series comprises a minor group of soils on the upper terraces northeast of Sicamous and west of Solsqua. The topography is from moderately to strongly sloping. Elevations lie between 1,300 and 1,650 feet. A total of 126 acres was mapped as a Syphon sandy loam-Tappen silty clay loam complex.

The parent material consists of a thin mantle of sandy to gravelly sandy slopewash which overlies the parent material of the

Tappen series. The overlay varies from eight to 36 inches thick. Areas of overlay deeper than 36 inches were mapped as the Hupel series. The surface textures are gravelly sandy loam and sandy loam; sandy loam is the most common. The most stony and gravelly areas are at the higher elevations, nearest to the sources of slopewash.

These Brunisolic Gray Wooded soils are moderately well to well-drained, depending on the thickness of the overlay. They support a medium heavy forest of Douglas fir, cedar, birch, and cottonwood, with an undergrowth of false box, prince's pine, kinnikinnick and twinflower. An undisturbed profile was described as follows:

Horizon	Depth Inches	Description
L-H	2 - 0	Chiefly coniferous litter. Common fine roots in F and H layers. pH 5.3.
(Aej)		Discontinuous, and less than ½-inch thick.
Ae1	0 -10	Pale-brown (10YR 6/3, dry) or brown to dark-brown (10YR 4/3, moist) sandy loam. Weak, fine subangular blocky structure. Soft when dry. Very friable when moist. Roots common. pH 6.5. Gradual boundary:
Ae2	10 -19	Light brownish gray (10YR 6/2, dry) or dark grayish brown (10YR 4/2, moist) fine sandy loam. Very friable when moist. Occasional roots. pH 6.5. Gradual boundary:
IIAB	19 -27	Light brownish gray to pale-brown (10YR 6/2.5, dry) or dark grayish brown (10YR 4/2, moist) silt loam. Moderate, medium subangular blocky structure. Slightly hard when dry. Friable when moist. Occasional roots. pH 6.2. Gradual boundary:
IIBt	27 -36	Light brownish gray to light yellowish brown (2.5Y 6/3, dry) or olive-brown (2.5Y 4/4, moist) silty clay. Weak, fine prismatic structure. Very firm when moist. Occasional roots. pH 6.2. Gradual boundary:
IIC	36 +	Light brownish gray to yellowish-brown (2.5Y 6/3, dry) or dark grayish brown to olive-brown (2.5Y 4/3, moist) stratified silty clay. Firm when moist. pH 6.5.

Land Use

A small acreage of the Syphon soils has been cleared and put under cultivation for hay. The remainder of the mapped areas have a medium-heavy stand of timber that is periodically logged.

According to suitability for irrigation, there are 27 acres of third and 99 of fourth class Syphon sandy loam-Tappen silty clay loam complex.

PODZOL SOILS

This Great Soil Group consists of rapidly to imperfectly drained soils that develop in humid areas. It is characterized by an L-H horizon of organic forest litter, beneath which is a light colored Ae eluvial horizon. In turn this is underlain by an illuvial Bf or Bfh horizon in which organic matter and sesquioxides are the main accumulation substances. The solum is moderately to strongly unsaturated, and usually underlain by non-calcareous materials or materials from which any free lime has been leached away. Minimal and Orthic subgroups were found in the surveyed area.

Minimal Podzol Soils

The Minimal Podzol has an L-H horizon of forest litter on the surface. Beneath the organic layer there is a light colored Ae horizon less than one inch thick, which is continuous. This horizon is underlain by an illuvial yellowish-brown to dark yellowish brown friable Bfh and/or Bf horizons more than eight inches thick, that contain accumulated organic matter and sesquioxides. The profile is unsaturated, strongly acid near the surface, and less acid at depths. In the surveyed area the Minimal Podzol is represented by the Malakwa, Shuswap and Hupel series.

Orthic Podzol Soils

This subgroup has an L-H horizon of forest litter on the surface. This is underlain by a light colored Ae horizon more than one inch thick, beneath which are friable yellowish-brown to strong-brown Bfh and/or Bf horizons. A few hard, magnetic, rounded, iron concretions occur in the upper part of the Bfh and/or Bf horizons. The Orthic Podzol is represented in the surveyed area by the Wap, Taft and Sitkum series.

Minimal Podzol Soils

MALAKWA SERIES

The Malakwa soils occupy gravelly, glacial outwash terraces between Cambie Bridge and Perry River. The topography varies from gently undulating to gently sloping and gently rolling; the slopes are from two to nine percent. The elevations of the series lie between 1,200 and 1,450 feet.

The terrace material is composed chiefly of stratified sands and gravels, overlain by gravelly, coarse sandy loam and loamy sand generally less than 18 inches thick. The overlay contains from moderate to excessive amounts of gravel, cobbles and stones. The soils were mapped as follows:

Malakwa gravelly sandy loam	1,210 acres
Malakwa gravelly sandy loam-Shuswap sandy loam complex	174 "

These Minimal Podzol Malakwa soils are rapidly drained. The climax forest was destroyed by fire. The present semi-open regrowth consists of hemlock and cedar, with occasional white pine, Douglas fir and birch. There is a dense undercover of false box, prince's pine, bunchberry, queen's cup, arelia, ferns, and scattered moss. An undisturbed profile was given the following description:

Horizon	Depth Inches	Description
L-H	$1\frac{1}{2}$- 0	Forest litter, decomposed in the lower part. Roots abundant. pH 4.0.
Ae	0 - $\frac{3}{4}$	Light brownish gray (10YR 6/2, dry) or grayish brown (10YR 5/2, moist) sandy loam. Single-grained. Horizon varies from $\frac{1}{4}$ to one inch thick. Soft when dry. Roots abundant. Abrupt boundary:
Bfh1	$\frac{3}{4}$- 4	Dark yellowish brown (10YR 4/4, dry) or brown to dark-brown (10YR 4/3, moist) gravelly sandy loam. Very weak fine to medium subangular blocky structure. Soft when dry. Roots abundant. pH 5.7. Abrupt boundary:
Bfh2	4 - 8	Yellowish-brown (10YR 5/4, dry) or dark yellowish brown (10YR 3/4, moist) gravelly sandy loam or loamy sand. Very weak, fine to medium subangular blocky breaking to fine granular structure. Soft when dry. Roots abundant. pH 6.1. Clear boundary:

Horizon	Depth Inches	Description
BC	8 -15	Yellowish-brown (10YR 5/4, dry) or dark yellowish brown (10YR 3.5/4, moist) gravelly sand. Single-grained. Scattered small cobbles. Loose when dry. Common roots. pH 5.9. Clear boundary:
IIC	15 +	Clean gravelly sand of variegated colors. Numerous cobbles. Loose when dry. Occasional roots. pH 5.9.

Land Use

Small areas of Malakwa soils have been cleared for cultivation. Due to the shallow solum and high porosity, these soils are droughty and poor to doubtful for forage and cereals, particularly without irrigation. When cultivated they require organic matter, lime and fertilizers. The regrowth of the native vegetation has little value for timber, and the grazing value for stock is low. However, this series has more definite value as a source of gravel and sand for road and other construction.

As to suitability for irrigation, there are 28 acres of fourth and 1,155 of fifth class Malakwa gravelly sandy loam, and 174 of fourth class Malakwa gravelly sandy loam-Shuswap sandy loam complex.

SHUSWAP SERIES

These soils occupy sandy glacial outwash terraces between Cambie Bridge and Perry River. The topography is from gently undulating to rolling and strongly rolling. Strongly rolling relief occurs on the higher terraces east of Malakwa. The elevations are from 1,200 to 1,450 feet.

The parent material consists of sandy glacial outwash; the coarser sands are the most common. At shallow depths, the sands are underlain by gravelly outwash. The Shuswap soils have more than 30 inches of sands overlying gravels. Where the surface texture carries down to 30 inches the soils were mapped as a deep phase. They were separated as follows:

Shuswap sand	9	acres
Shuswap loamy sand	199	"
Shuswap sandy loam	29	"
Shuswap sandy loam to loam, deep phase	66	"
Shuswap sandy loam-Malakwa gravelly sandy loam	137	"
Shuswap sandy loam-Taft sandy loam-Tappen silty clay loam	427	"

The Shuswap series is composed of rapidly drained Minimal Podzol soils. The native vegetation consists of Douglas fir, white pine, hemlock, cedar, aspen, and a dense undercover of false box, bunchberry, arelia, thimbleberry, prince's pine, twinflower, queen's cup, ferns, and scattered moss. An undisturbed profile in regrowth was described as follows:

Horizon	Depth Inches	Description
L-H	$1\frac{1}{4}$- 0	Forest litter, decomposed in the lower part. Roots abundant. pH 4.0.
Ae	0 - 1	Light brownish gray (10YR 6/2, dry) or grayish-brown (10YR 5/2, moist) sandy loam. Single-grained. Horizon from $\frac{1}{2}$ to one inch thick. Loose when dry. Roots abundant. pH 4.2. Abrupt boundary:
Bf1	1 - 6	Yellowish-brown (10YR 5/4, dry) or brown to dark-brown (7.5YR 4/4, moist) sandy loam. Weak, fine to medium subangular blocky structure. Soft when dry. Roots abundant. pH 5.9. Clear boundary:
Bf2	6 -11	Yellowish-brown (10YR 5/4, dry) or dark yellowish brown (10YR 3/4, moist) loamy sand. Very weak, fine to medium subangular blocky breaking to single-grain structure in the lower part. Soft when dry. Roots common. pH 6.2. Clear boundary:
BC	11 -19	Brown (10YR 5/3, dry) or yellowish-brown (10YR 5/4, moist) sand. Single-grained. Soft when dry. Occasional roots. pH 6.0. Gradual boundary:
C	19 -26	Brown (10YR 5/3, dry) or yellowish-brown (10YR 5/4, moist) sand. Single-grained. Iron staining scattered and with tongues into IIC. Loose when dry. Occasional roots. pH 6.2. Clear boundary:
IIC	26 +	Clean coarse sand of variegated colors. Single-grained. Loose when dry. pH 6.4.

Land Use

A small acreage of Shuswap soils have been cleared and the balance is in forest. The quality of the soils is in the range from fair to doubtful for irrigation, depending on the topography and texture.

With irrigation they would produce cereals and forage crops. Since the fertility status is low, and acidity at the surface fairly high, liming, fertilization and organic matter are all required.

The forest cover is largely regrowth having limited value for timber at the time of the survey (1963), and carrying capacity for grazing is also limited. The classification of these soils according to suitability for irrigation is given in Table 4

HUPEL SERIES

These soils are derived from alluvial-colluvial fans in the area between Sicamous and Perry River. The fan topography is steeply to moderately sloping toward the valley centre. The elevations lie between 1,200 and 1,600 feet.

The creek-deposited parent material is coarse textured. The alluvium is derived chiefly from the erosion of glacial till and outwash which occupies higher elevations in the watersheds of the streams. Stoniness is heavy and excessive in the upper sections of the fans, and thins to moderate amounts near the fan aprons. The surface textures are gravelly loamy sand and gravelly sandy loam. The soils were mapped as follows:

Hupel gravelly loamy sand	610 acres
Hupel gravelly loamy sand-gravelly sandy loam	142 "
Hupel gravelly sandy loam	273 "
Hupel gravelly loamy sand-Grindrod gravelly loamy sand complex	25 "
Hupel gravelly sandy loam-Syphon sandy loam complex	47 "

The Minimal Podzol Hupel soils are from well to rapidly drained. They support regrowth of Douglas fir, hemlock, cedar, white pine, and an undercover of mountain yew, saskatoon, false box, arelia, queen's cup, prince's pine, bunchberry, twinflower, ferns, and scattered moss. An undisturbed profile was given the following description:

Horizon	Depth Inches	Description
L-H	1 - 0	Forest litter, decomposed in the lower part. Roots abundant. pH 5.9.
Ae	0 - $\frac{1}{2}$	Light brownish gray (10YR 6/2, dry) or grayish-brown (10YR 5/2, moist) sandy loam. Single-grained. Horizon varies from $\frac{1}{4}$ to one inch thick. Loose when dry. Roots abundant. Abrupt boundary:

Horizon	Depth Inches	Description
Bf1	$\frac{1}{2}$- 3	Yellowish-brown to dark yellowish brown (10YR 4.5/4, dry) or brown to dark-brown (7.5YR 4/4, moist) gravelly loamy sand. Very weak, fine subangular blocky structure. Soft when dry. Scattered cobbles. Roots abundant. pH 6.5. Clear boundary:
Bf2	3 -10	Yellowish-brown (10YR 5/4, dry) or brown to dark-brown (7.5YR 4/4, moist) gravelly loamy sand. Very weak, fine subangular blocky breaking to singe-grain structure in the lower part. Soft to loose when dry. Scattered cobbles. Roots abundant. pH 6.6. Clear boundary:
IIC1	10 -22	Pale-brown (10YR 6/3, dry) or brown (10YR 5/3, moist) gravelly and cobbly coarse sand. Single-grained. Loose when dry. Common to occasional roots. pH 6.2. Gradual boundary:
IIC2	22 +	Gravelly, cobbly and stony coarse sand. Single-grained. Loose when dry. pH 6.1.

Land Use

Small and scattered areas of the Hupel soils were cleared and in forage crops at the time of the survey (1963). Most of the acreage was in forest. The forest has limited use for grazing, and is logged periodically.

A part of the acreage is not suitable for agriculture because of stoniness and coarse texture. The less stony areas would produce forage if irrigated. Lime, organic matter and fertilizers are necessary soil amendments.

Of the soils suitable for irrigation, there are 135 acres of fifth class Hupel gravelly loamy sand, 142 of fifth class gravelly loamy sand-gravelly sandy loam, 95 of fourth and 107 of fifth class gravelly sandy loam, 25 of fifth class Hupel gravelly loamy sand-Grindrod gravelly loamy sand complex, and 47 of fourth class Hupel gravelly sandy loam-Syphon sandy loam complex.

Orthic Podzol Soils

WAP SERIES

The Wap soils occupy gravelly, glacial outwash terraces and deltaic deposits between Craigellachie and Wap creeks. The topography consists of a mixture of simple and complex slopes that vary from very gently sloping and undulating to steeply sloping and strongly rolling. The elevations of these soils vary from 1,450 to 2,700 feet.

The terraces are composed of deposits of stratified sands and gravel that can vary up to 150 feet or more thick. These are capped by coarse gravelly sandy loam over a layer of gravelly loamy sand, the two layers together being usually less than 18 inches thick. Gravel and stones in the overlay vary in amounts from moderate to excessive. Surface textures are mainly gravelly sandy loam, with inclusions of gravelly loamy sand. The soils were mapped as follows:

Wap gravelly sandy loam	933 acres
Wap gravelly sandy loam-Taft sandy loam complex	734 "

In the above totals, 508 acres of Wap gravelly sandy loam and 714 of Wap gravelly sandy loam-Taft sandy loam complex are nonarable.

The rapidly drained Wap soils are Orthic Podzols. Much of the acreage has not been burned in recent time. The cover consists of a mature stand of hemlock, with an understory of young hemlock and cedar. Where fire has destroyed this growth, the vegetation is similar to that on the Malakwa and Shuswap series. The well-shaded undercover of the climax forest consists of bunchberry, prince's pine, queen's cup, twinflower, and moss. An undisturbed profile was described as follows:

Horizon	Depth Inches	Description
L-H	2 - 0	A horizon of largely undecomposed forest litter from one to three inches thick, with moss cover. Roots abundant. pH 4.0.
Ae	0 - 1½	Light-gray (10YR 6/1, dry) or gray (10YR 5/1, moist) sandy loam. Single-grained. Horizon one to 2½ inches thick with tongues to four inches in depth. Soft when dry. Roots abundant. pH 4.2. Abrupt but irregular boundary:
Bfh	1½- 6	Strong-brown (7.5YR 5/6, dry) or brown to dark-brown (7.5YR 4/4, moist) gravelly sandy loam. Single-grained. A few hard, scattered concretions up to ½ inch diameter. Soft when dry. Scattered small cobbles. Roots abundant. pH 5.8. Clear boundary:

Horizon	Depth Inches	Description
Bf	6 -10	Yellowish-brown to dark yellowish brown (10YR 4.5/4, dry) or dark yellowish brown (10YR 3/4, moist) gravelly loamy sand. Single-grained. An occasional hard concretion up to 3/8 inch diameter. Loose when dry. Scattered small cobbles. Roots common. pH 5.8. Abrupt boundary:
IIC	10 -18	Gravelly sand. Single-grained. Scattered cobbles with cemented sand attached. Loose when dry. Occasional roots. pH 5.8. Gradual boundary:
IIIC	18 +	Stratified clean gravel and coarse sand. Single-grained. Loose when dry. Scattered cobbles. pH 5.8.

Land Use

At the time of the survey (1963) the total acreage of the Wap soils was in forest. Where unburned in recent time there were stands of over-mature hemlock, and in burned areas the cover consisted of moderately young regrowth.

The Wap soils are in the doubtful class for agriculture, even with irrigation, because of coarse texture, stoniness, shallow solums and low fertility. Where the forest is mature they have no value for grazing.

According to suitability for irrigation, there are 425 acres of fifth class Wap gravelly sandy loam, and 20 of fifth class Wap gravelly sandy loam-Taft sandy loam complex.

TAFT SERIES

These soils were mapped on sandy glacial outwash and deltaic materials between Craigellachie and Wap creeks in the Eagle Valley. The topography is a mixture of simple and complex slopes that vary from very gently sloping and undulating to steeply sloping and strongly rolling. The elevations at which the Taft soils occur are between 1,450 and 2,000 feet.

The parent material is composed of sands deposited as terraces or deltas. These are underlain by gravel. Where the sands were more than 30 inches thick over gravel, they were classed in the Taft series; shallower sands were assigned to the Wap series. In the average solum, sandy loam changes to loamy sand and sand at depths from six to 18 inches. Where the surface texture carries down from 18 to 30 inches, the soil was classed as a deep phase. The Taft series was mapped as follows:

Taft loamy sand	29 acres
Taft sandy loam	229 "
Taft sandy loam, deep phase	29 "
Taft sandy loam-Shuswap sandy loam complex	138 "

The well to rapidly drained Taft soils are Orthic Podzols. They support a forest of hemlock and stunted cedar. In burned areas the vegetation is similar to that of the Malakwa and Shuswap soils. The light undercover is composed of false box, prince's pine, queen's cup, twinflower, ferns, and an extensive distribution of moss. An undisturbed profile was described as follows:

Horizon	Depth Inches	Description
L-H	1½- 0	Chiefly undecayed forest litter covered by moss. Abundant roots. pH 4.4.
Ae	0 - 2½	Light-gray (10YR 6/1, dry) or gray (10YR 5/1, moist) sandy loam. Single-grained. Horizon is from one to three inches thick, with tongues to 3½ inches depth. Loose when dry. Abundant roots. pH 4.9. Clear but irregular boundary:
Bf1	2½- 7	Yellowish-brown (10YR 5/4, dry) or brown to dark-brown (7.5YR 4/4, moist) sandy loam or loamy sand. Single-grained. A few hard, scattered concretions up to ½ inch diameter. Soft when dry. Roots abundant. pH 6.1. Clear boundary:
Bf2	7 -11	Yellowish-brown (10YR 5/4, dry) or dark yellowish brown (10YR 3/4, moist) loamy sand. Single-grained. An occasional hard concretion up to 3/8 inch diameter. Soft when dry. Roots common. pH 6.1. Clear boundary:
BC	11 -17	Pale-brown (10YR 6/3, dry) or brown (10YR 4.5/3, moist) sand. Single-grained. Loose when dry. Occasional roots. pH 6.1. Clear boundary:
C1	17 +	Clean sand of variegated colors. Single-grained. Loose when dry. Occasional roots. pH 6.1.

Land Use

Only three small areas of Taft soils were cleared and in forage crops at the time of the survey (1963). The forested areas support mature hemlock and regrowth. The soils are poor to doubtful for farming, because of coarse texture, shallow, sandy solum and low fertility, even with irrigation. Organic matter, lime and fertilizers are all required for crop production.

Of the soils suitable for irrigation, there are 29 acres of fifth class Taft loamy sand, 39 of fourth and 190 of fifth class sandy loam, 29 of fifth class sandy loam, deep phase, and 82 of fifth class Taft-Shuswap complex.

SITKUM SERIES

These soils are derived from fans in the area between Perry River and Wap Lake. The topography varies from moderately to steeply sloping; slopes are from six to 30 percent. The elevations lie between 1,300 and 2,000 feet.

The parent material is bouldery, stony, cobbly, gravelly sandy loam deposits of creeks and slopewash. These deposits are for the most part excessively stony. The greatest stone concentrations are at the apexes of the fans. The stones become progressively smaller in size and quantity toward the fan margins. Surface textures are gravelly loamy sand and sandy loam. The following soils were separated:

Sitkum gravelly loamy sand	922 acres
Sitkum gravelly loamy sand-gravelly sandy loam	328 "
Sitkum gravelly sandy loam	165 "

All except 165 acres are nonarable.

The Sitkum soils are rapidly drained Orthic Podzols. There is some imperfect drainage along the lower edges of the fan aprons adjacent to Wap Creek and the Eagle River. The forest cover varies with frequency of fire and stability of slopes. There is hemlock, cedar, scattered Douglas fir, birch, and white pine, and a light undercover of false box, bunchberry, queen's cup, twinflower, and a thin moss cover on the ground. An undisturbed profile was given the following description:

Horizon	Depth Inches	Description
L-H	1 - 0	Forest litter, decomposed in the lower part. Moss cover. Roots abundant. pH 5.4.

Horizon	Depth Inches	Description
Ae	0 - 1	Light-gray (10YR 6/1, dry) or gray (10YR 5/1, moist) sandy loam. Single-grained. Horizon ½ - 1¼ inches thick, tongues penetrating Bfh1 to two inches. Loose when dry. Roots abundant. pH 5.0. Abrupt but irregular boundary:
Bfh1	1 - 3	Strong-brown (7.5YR 5/6, dry) or dark reddish brown (5YR 3/4, moist) gravelly sandy loam. Very weak, fine to medium subangular blocky structure. Soft when dry. Scattered cobbles and small stones. Roots abundant. pH 5.6. Abrupt boundary:
Bfh2	3 -10	Yellowish-brown (10YR 5/4, dry) or brown to dark-brown (7.5YR 4/4, moist) gravelly sandy loam. Very weak, fine to medium subangular blocky breaking to single-grain structure in the lower part. Soft when dry. Scattered cobbles and small stones. Roots abundant. pH 5.6. Gradual boundary:
IIC	10 +	Stony, cobbly, gravelly sand. Loose when dry. Occasional roots to 24 inches or more. pH 5.5.

Land Use

Aside from three small, cleared areas, the Sitkum soils were occupied by forest at the time of the survey (1963). Only a small acreage in the doubtful category was regarded as arable.

The area that may be reclaimed, consists of 165 acres of fifth class Sitkum gravelly sandy loam.

ORGANIC SOILS

Deposits of muck occur in poorly drained depressions in which a high water table favors accumulation of organic residues. The deposits are more than 12 inches thick. The plant remains in the various deposits are derived chiefly from trees and sedges. The materials are well decomposed near the surface. In the Eagle Valley these soils are strongly acid. The organic deposits are underlain by gleyed mineral soil material. In the mapped area the representative is Okanagan Muck.

OKANAGAN MUCK

Most of the acreage is on the floodplain near Malakwa; there is a minor area near Crazy Creek. The topography is very gently undulating and undulating to gently sloping. Elevations vary from 1,200 to 1,400 feet. A total of 319 acres were mapped, of which 16 are nonarable.

The parent material consists of organic residue more than 24 inches thick. It is composed of sedge and woody debris grading from well decayed and unidentifiable muck near the surface to raw and fibrous peat at depths. The deposits are very poorly drained. A water table exists at or near the surface. When the deposits are drained, the water table may be several feet deep.

The native vegetation varies with location and drainage. Some areas are sedge meadow; others have stunted willow, hardhack and tules. Still others have light forest cover. A cultivated profile was described as follows:

Horizon	Depth Inches	Description
Hp	0 - 7	Very dark brown (10YR 2/2, moist) muck. Well decomposed. pH 4.9.
F-H	7 -22	Very dark brown (10YR 2/2, moist) muck. Well to in part decayed mucky peat. pH 5.6.
L	22 -48	Very dark grayish brown (10YR 3/2, moist) peat. Layered, identifiable, undecomposed. Water table at 42 inches. pH 5.2.

Land Use

South of Malakwa the muck soils have been reclaimed and drained by ditches, and sedges are cut for hay. A more complete drainage system is required. With adequate drainage reed canary grass would yield a better hay crop, or make better pasture. These soils are also excellent for the production of vegetables when adequately drained and fertilized.

With adequate drainage the muck soils may require irrigation. For this purpose, there are 262 acres of fourth and 41 of fifth class land.

MISCELLANEOUS LAND TYPES

Gravel Pits

Three gravel pits which occupy 25 acres were mapped near Malakwa and Cambie Bridge.

Lakes

Willis, Griffin, Three Valley, and Wap lakes occupy 709 acres.

Ponds

About 53 acres of shallow ponds occur in the upper Wap Creek valley and south of Willis Lake.

Swamps

A total of 1,075 acres were classified as swamps. These are located in the valley bottom of the upper Eagle River and Wap Creek. Water occurs at the surface and vegetation varies from a light deciduous cover, mostly willow, to minor areas of raw peat with Labrador tea and related bog plants.

Rough Mountainous Land

Within the mapped area, 259 acres were classified as rough mountainous land. The topography is extremely sloping and the land is composed of bedrock, colluvium over till or till.

Undifferentiated Steep Slopes

These are areas of very steeply and extremely sloping land which occupy a total of 282 acres. They include a variety of parent materials, including sandy and gravelly outwash, glacial till and bedrock. Deep eroded creek gullies are included.

CLASSIFICATION ACCORDING TO SUITABILITY FOR IRRIGATION

Table 4 lists the soils according to suitability for irrigation. Class I to IV soils are recommended for agriculture. Class V is not recommended. In the Eagle Valley map-area, Class V is best left in the native state or used for a non-agricultural purpose.

The method of classification according to suitability for irrigation is outlined elsewhere (13). Short definitions of the irrigable land classes are as follows:

CLASS I SOILS

These are the soils most suitable for irrigation. This class includes deep, uniform, well-drained soils of medium to fine texture, such as fine sandy loam, loam, silt loam, and silty clay loam. Class I soils have desirable structure and other profile features, with little or no deduction for alkali, adverse topography or stoniness. Soils of this class are capable of producing most commercial crops that can be grown under prevailing climatic conditions.

CLASS II SOILS

These are good irrigation soils. Class II includes well-drained sandy loam and soils of medium to fine textures with little or no deduction for alkali, but moderate deductions for adverse topography, stoniness, and impeded drainage. Soils of this class are capable of producing most of the commercial crops that can be grown on Class I soils, but are given a lower classification because of less uniformity.

CLASS III SOILS

Class III are fair irrigation soils. It includes soils of similar textures to those of Class I and II. There is little or no deduction for alkali, but moderate to high deductions for adverse topography, stoniness, and impeded drainage, etc. Moderately well-drained heavy clays and comparatively stone-free gravelly river terraces and channel deposits are included. Soils of this class are less suited to irrigation than those of Class II and have a more limited range of crop adaptation.

CLASS IV SOILS

These are poor irrigation soils. This class includes soils of limited use as a result of thin solums, heavy concentrations of gravel and/or stones, adverse topography, alkalinity, poor drainage, etc. They are restricted to fewer crops than Classes I to III, and generally to those which form a more or less permanent cover.

CLASS V SOILS

This class includes soils of doubtful suitability for irrigation. Such soils are characterized by coarse and shallow solums, rough or steep topography, extreme stoniness, etc. They have very limited use. They are restricted to crops that form a more or less permanent cover or native forest.

Table 4 - SUITABILITY OF EAGLE VALLEY SOILS FOR IRRIGATION

Soils	Irrigable Land Classes in Acres 2nd	3rd	4th	5th	Na*	Total
Duteau sandy loam	-	-	22	118	-	140
Duteau-Legerwood complex	-	-	-	90	-	90
Gardom series	-	-	61	16	-	77
Grindrod gravelly sand	-	-	-	-	114	114
Grindrod sand-sandy loam	-	-	-	95	-	95
Grindrod G.L.S.	-	-	-	-	30	30
Grindrod loamy sand-S.L.	-	-	178	-	-	178
Grindrod G.S.L.	-	-	-	27	-	27
Grindrod sandy loam	-	-	-	48	-	48
Grindrod fine sandy loam	-	54	-	-	-	54
Grindrod-Duteau complex	-	-	41	-	-	41
Hupel gravelly loamy sand	-	-	-	135	475	610
Hupel G.L.S.-G.S.L.	-	-	-	142	-	142
Hupel gravelly sandy loam	-	-	95	107	71	273
Hupel-Grindrod complex	-	-	-	25	-	25
Hupel-Syphon complex	-	-	47	-	-	47
Legerwood silt loam	-	-	337	18	-	355
Legerwood silt loam; Diatomaceous Earth Phase	-	257	-	-	-	257
Legerwood-Duteau-Mabel complex	-	-	-	-	130	130
Mabel complex	-	-	-	159	455	614
Mabel-Duteau complex	-	-	-	218	67	285
Malakwa G.S.L.	-	-	28	1,155	27	1,210
Malakwa-Shuswap complex	-	-	174	-	-	174
Okanagan Muck	-	-	262	41	16	319
Rumball silt loam	30	-	-	-	-	30
Rumball-Yard complex	-	-	46	-	-	46
Rumball-Duteau-Mabel complex	-	-	-	506	-	506
Shuswap sand	-	-	-	9	-	9
Shuswap loamy sand	-	-	199	-	-	199
Shuswap sandy loam	-	29	-	-	-	29
Shuswap sandy loam-loam; Deep Phase	-	61	5	-	-	66

Table 4 - continued

Soils	Irrigable Land Classes in Acres					
	2nd	3rd	4th	5th	Na*	Total
Shuswap-Malakwa complex	-	-	-	137	-	137
Shuswap-Taft-Tappen complex	-	-	427	-	-	427
Sitkum G.L.S.	-	-	-	-	922	922
Sitkum G.L.S.-G.S.L.	-	-	-	-	328	328
Sitkum G.S.L.	-	-	-	165	-	165
Solsqua silt loam	1,069	-	-	-	-	1,069
Solsqua silt loam; Shallow Phase	-	600	-	-	-	600
Solsqua-Legerwood complex	50	-	-	-	-	50
Solsqua-Rumball complex	-	391	-	-	-	391
Solsqua-Yard complex	139	55	-	-	-	194
Solsqua-Rumball-Legerwood complex	-	103	-	-	-	103
Solsqua-Yard-Rumball complex	-	61	-	-	-	61
Syphon-Tappen complex	-	27	99	-	-	126
Taft loamy sand	-	-	-	29	-	29
Taft sandy loam	-	-	39	190	-	229
Taft S.L.; Deep Phase	-	-	-	29	-	29
Taft-Shuswap complex	-	-	-	82	56	138
Wap gravelly sandy loam	-	-	-	425	508	933
Wap-Taft complex	-	-	-	20	714	734
White gravelly sandy loam	-	-	89	-	120	209
White sandy loam	-	14	-	-	-	14
Yard sandy loam	-	485	-	-	-	485
Yard-Duteau complex	-	-	9	-	-	9
Yard-Rumball complex	-	286	-	-	-	286
Yard-Solsqua complex	-	49	-	-	-	49
Gravel Pits	-	-	-	-	25	25
Lakes	-	-	-	-	709	709
Ponds	-	-	-	-	53	53
Swamps	-	-	-	-	1,075	1,075
Rough Mountainous Land	-	-	-	-	259	259
Undifferentiated Steep Slopes	-	-	-	-	282	282
Totals	1,288	2,472	2,158	3,986	6,436	16,340

G.L.S.: gravelly loamy sand, G.S.L.: gravelly sandy loam, S.L.: sandy loam, *Na: Nonarable land.

CHEMICAL ANALYSES

Partial chemical analyses of Eagle Valley soils is given in Table 5. The samples analysed were from soil profiles described in this report. The results are a guide to soil classification and they also provide preliminary information as to soil fertility. However, detailed study at the farm level is an additional requirement before definite recommendations could be made in regard to fertilizer applications. The following discussion of soil properties is intended to aid interpretation of the chemical data in the accompanying table:

Soil Reaction

Soil reaction is expressed as pH. This is the negative logarithm of the activity of hydrogen ions in solution. It is expressed in values from zero to 14. Soils are acid at pH 6.5 or less, neutral from pH 6.6 to 7.3, and alkaline if the pH is 7.4 or higher. In the range from humid to semi-arid climates, the pH is from 4.0 to 8.4. Certain peat soils may have a pH less than 3.0, and black alkali accumulations in dry areas may reach pH 10.5. The most favorable range for crops is pH 6.6 to 7.3.

Determination of pH is the most common one practiced in soil analysis. This is necessary in order to know the chemical status of a soil, and it serves as a guide to plant nutrient availability. The solubility and availability of the major and minor elements used by plants is closely related to the soil pH, as is the activity of soil micro-organisms, and the rate at which they decompose organic matter. Many soil-borne plant diseases survive only at certain pH values.

Organic Matter

The organic matter content of soils is related to precipitation, drainage, vegetation, temperature, and other factors. It can vary from less than one percent in mineral soils to 100 percent in organic ones. Its maintenance in cultivated mineral soils is of major importance in connection with soil fertility.

The best known functions of organic matter in the soil are those related to physical and chemical properties. Additions of organic matter make soils less susceptible to crusting, more friable and easier to work, better aerated, and more resistant to erosion. It also increases moisture holding capacity and the supply and ability to absorb nutrient elements. The population of bacteria in the soil is increased with an increase of humus. The decomposition of organic matter by micro-organisms releases plant nutrients and thus increases crop yields.

Nitrogen

In the Eagle Valley, crop yields may be determined by soil nitrogen more than any other mineral element, and by moisture. With adequate moisture, nitrogen is required by plants in large amounts and also it is easily lost by leaching. Successful farming includes efficient management of the nitrogen supply.

Plants require most nitrogen in their growth period. This is available from soil organic matter or it may be supplied as fertilizer. In addition, a minor source is the atmosphere. From two to six pounds per acre of nitrogen is washed from the atmosphere annually by rains. Most of this is fixed by the action of lightning as nitrous oxide and converted to plant use by micro-organisms.

Micro-organisms play an important role in the provision of nitrogen to plants. Two large groups are ammonifiers and nitrifiers. Through their activities nitrogen in organic matter and atmospheric nitrogen are made available for plant nutrition.

The most efficient use of this element by the farmer involves prevention of soil erosion, the application of manure and crop residues, the introduction of nitrogen fixing bacteria by inoculating the soil, and the application of any additional nitrogen that may be necessary in the form of commercial fertilizers.

Inasmuch as soil nitrogen is derived from several sources, estimation of its status by chemical tests is difficult. Response to nitrogen fertilizer depends on previous cultural practice and the weather in any growing season. Analytical values for total nitrogen in soil serve as a guide as to the nitrogen supplying power of the soil. The following percentage levels may be used:

Very low	.10	percent
Low	.10 to .25	"
Medium	.25 to .40	"
High	.40 plus	"

Phosphorus

Phosphorus is present in all living tissue. It concentrates chiefly in the younger parts of plants, and in the seed. Growth becomes slow and maturity is delayed in a plant when available soil phosphorus is inadequate. Most of the phosphorus in the soil exists in forms that are fixed and unavailable to the plant.

Available phosphorus is derived from the weathering of soil minerals and decomposition of organic matter. Micro-organisms convert organic phosphorus to inorganic forms that are available. When phosphorus is applied as fertilizer it does not move from the point of application. Therefore, such fertilizer applications should be placed near the roots to ensure that it will supply the growing plant.

The apatite minerals are the sources of most of the soil phosphorus. As weathering proceeds, these forms slowly convert into more stable adsorbed forms of phosphorus. In mature soils of humid climates acid conditions prevail and most of the phosphorus exists as iron and aluminum phosphates. In young soils that have calcareous parent materials and in the calcareous soils of dry climates, calcium phosphate predominates.

Iron and aluminum phosphates are least soluble at pH 4.0. As pH increases solubility is also increased. Calcium phosphates begin to form around pH 6.0. Their solubility decreases as the reaction approaches pH 7.5; the greatest availability is in the range from pH 6.5 to 7.0. As pH increases from pH 7.5 to 8.5, there is a decrease of availability.

When phosphorus is applied as fertilizer, it changes to forms similar to those present in the soil. Iron, aluminum and calcium combine with the water-soluble phosphates of fertilizer and thus convert them to less soluble forms. This effect, called fixation, may reduce the efficiency of added phosphorus to different extents in different soils. Such differences of efficiency result from differences of the pH of the soils.

In Table 5 the data were determined by the Bray P_1 method (adsorbed phosphorus), which measures the available forms. Research results with Thompson and Okanagan valley soils growing alfalfa indicate that phosphate fertilizer applications are not necessary if a soil test is above 25 parts per million by the Bray P_1 method. The following values may be used as a guide as to the relative available level of phosphorus in soils:

	Parts per Million	Pounds per Acre*
Very low	Less than 5	Less than 10
Low	5 to 10	10 to 20
Moderate	10 to 20	20 to 40
Moderately high	20 to 30	40 to 60
High	30 plus	60 plus

Sulphur

Sulphur is essential to plant life. Many plants use as much sulphur as phosphorus. It is a constituent of plant proteins and some hormones. It is associated with the formation of chlorophyll and it has an effect on carbohydrate metabolism. It also affects the development of the nodules on legume roots associated with nitrogen fixation.

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*To obtain pounds per acre of phosphorus in Table 5, multiply by two. The values are based on two million pounds of soil per acre.

Sulphur is derived by micro-organisms from organic matter and oxidized to sulphates, the form in which it is used by plants. Other sources are soil minerals, sulphur in rain, and as sulphur dioxide in the atmosphere which can be absorbed by plant leaves. In some cases sulphur is supplied by irrigation water to the extent of supplying crops with their total requirements. Certain fertilizers contain sulphur. Where sulphur is deficient in the soil, the application of this element has produced increases of yield at one time attributed to phosphatic fertilizer.

Sulphur deficiency in plants is similar in effect to nitrogen deficiency. The plants are stunted, with leaves pale-green to yellow in color. Sulphur deficiency can show up if nitrogen levels are too high.

In Table 5 data for available sulphur is presented. The results were obtained by extraction with ammonium acetate. Research in the Thompson and Okanagan valleys indicate that alfalfa requires soil test values of less than 16 pounds per acre (8 parts per million) by ammonium acetate extraction to show yield increase from sulphur application. The following values may be used as a guide to the relative requirements of available sulphur for plant growth:

	Parts per Million	Pounds per Acre*
Very low	Less than 2	4
Low	2 to 6	4 to 12
Moderate	6 to 10	12 to 20
Moderately high	10 to 20	20 to 40
High	20 plus	40 plus

Cation Exchange Capacity

The process of interchange between cations in exchangeable form and in solution is known as cation exchange. The cation exchange capacity represents the total number of exchangeable cations. This is expressed as milli-equivalents per 100 grams of oven-dry soil, and can range from almost none to over 100.

The main sources of cation exchange capacities are organic matter and clay minerals. In peat, muck and mineral soils high in organic matter, the high cation exchange capacity is attributable to the organic matter. In soils with low organic matter the exchange capacities are found mainly in the mineral fraction.

The cation exchange capacity of the mineral fraction depends upon the area of surface of the particles and the nature of the surface. The smaller particles have a greater surface area per

*To obtain pounds per acre of sulphur (S) from Table 5, multiply by two. Values are related to two million pounds per acre of soil.

unit of weight and a larger cation exchange capacity than the larger ones. Because most of the cation exchange capacity in the mineral portion of the soil is in the clay fraction, the clay content is of importance. The clay fractions contain a number of minerals, the conduct of which may differ.

According to Grim (7) the exchange capacity in milli-equivalents per 100 grams of oven-dry clay is three to 15 for kaolinite, 10 to 40 for illite and chlorite, and 80 to 150 for montmorillonite. Thus, identification of the clay minerals permits better understanding of the cation exchange capacity of a soil and its fertility potential.

Since the cation exchange capacity depends on the content of organic matter and clay in a soil, and this varies from horizon to horizon, the exchange capacities of different soil horizons are of interest. It is also possible to study the cation exchange capacities of different soil series, families, subgroups, and groups, and sort out the differences that occur. The data in Table 5 show cation exchange capacities of soils in the surveyed area. The following values may be used as a guide to the relative levels of the cation exchange capacities of soils:

	Milli-equivalents per 100 grams of soil
Very low	Less than 5
Low	5 to 10
Medium	10 to 20
High	20 plus

Exchangeable Cations

The principal exchangeable cations, or exchangeable bases, are in terms of the relative quantities of calcium, magnesium, potassium, sodium, aluminium, and hydrogen. The amounts vary from soil to soil, depending on inherited characteristics and past management of cultivated soils. In humid regions, where soils are acid, hydrogen and aluminium are the dominant cations. In arid and semi-arid areas the soils are neutral to alkaline, are highly base saturated, and calcium and magnesium are the dominant cations.

Primary minerals and silicate clays are the two main sources of non-exchangeable bases. The rate of their release to exchangeable forms is directly proportional to the intensity of weathering. Soils in regions of maximum weathering lose the supply of non-exchangeable bases faster than those in drier climates. Soil acidity indicates that the non-exchangeable bases are not being released fast enough to keep the exchangeable bases in equilibrium. Thus the percentage base saturation indicates the relationship between loss of exchangeable bases and their replacement from the non-exchangeable storage.

When percentage base saturation drops below 25 to 35 percent, an understanding of the exchange capacity and percentage base saturation is necessary in order to estimate the lime requirement to neutralize a soil.

The levels of exchangeable potassium indicate the supply of available potassium. Though in the exchangeable form in relatively small quantities, it is used by plants in large amounts, and its fluctuations of quantity are wider than for calcium and magnesium. Data are presented in Table 5 for exchangeable potassium of some Eagle Valley soils. The following values may be used as a guide to the relative levels of exchangeable potassium needed for forage crops:

	Milli-equivalents per 100 grams*	Pounds per Acre
Low	Less than 0.1	78
Moderate	0.1 to 0.2	78 to 156
Moderately high	0.2 to 0.3	156 to 235
High	0.3 plus	235 plus

Methods of Analyses

The soil reaction was determined by a method described by Peach (12). Soil organic matter was obtained by the wet combustion method also described by Peach (12). Total nitrogen was determined by the method described by Atkinson *et al* (1), modified by use of selenium as a catalyst as suggested by Bremner (4). Available phosphorus was obtained by the method described by Laverty (8). Sulphur was determined by the method described by Bardley *et al* (2).

Analysis for exchangeable cations and exchange capacity were undertaken by the method described by Peach (12). Cation exchange capacity was determined on the ammonium acetate extract. Versenate titration was used to determine calcium plus magnesium, using Erichrome Black T as an indicator, and calcium alone using Calcon as the indicator. Analyses for potassium and sodium were obtained by using a Beckman B flame spectrophotometer.

INTERPRETATION OF CHEMICAL ANALYSES

Table 5 contains data pertaining to 14 of 18 soil series in the surveyed area. In addition, data are presented for six composite soil samples of the Solsqua series, which has the largest acreage of potentially arable land.

*To convert milli-equivalents per 100 grams of oven-dry soil to pounds per acre, multiply by 782. The values are based on a weight of soil of two million pounds per acre.

The soils of the area developed under forest and relatively high precipitation. The effect of leaching is extensive, so the soils are acid to neutral in the range between pH 4.2 and 7.1. The White series, which developed on calcareous parent material, has alkaline reactions in the subsoil.

The content of organic matter varies from 50 to 100 percent in the Muck and Peaty Gleysol soils to less than one percent in the subsoils of the mineral soils. The analyses for nitrogen are closely related to the content of organic matter. Carbon-nitrogen ratios from 10 to 17 are optimum for nitrogen availability. In spite of the narrow ratios that occur, there are nitrogen deficiencies in most of the soils.

Available phosphorus by the Bray P_1 method indicates a wide range as between soil series. Values are from low to high; some of the soil series have adequate natural phosphorus. Experimentation and further analyses would be required before specific recommendations could be made as to the phosphorus requirements of these soils.

Available sulphur appears to be deficient in all soil analyses except the Minimal and Orthic Podzols. In the Podzols the available sulphur is associated with organic matter and sesquioxides in the Bf or Bfh horizons of the profiles. It is assumed that the sulphur in these soils is derived from decomposition of the L-H horizon of forest litter, which is deeper than in most of the mineral soils. However, in any of these soils, sulphur would become deficient after years of cultivation, and some would have to be added.

The cation exchange capacity varies from 1.7 to 43.7 milliequivalents per 100 grams of oven-dry soil; the values depending on the content of organic matter and clay. Base saturation percentages vary from 2.4 to 100 percent; the Podzols have the lowest and the Brown Wooded soils the highest percentages.

Exchangeable calcium and magnesium are very low in the Podzols and high in the Brown Wooded soils. The Gleysolic soils have low to medium calcium and magnesium in their organic horizons at the surface and very low amounts in the subsoils. Well to imperfectly drained soils of loam or heavier textures have medium to high calcium and magnesium compared with sandy loam and lighter textures, which are low in these constituents. The analyses indicate that applications of lime should be made to cultivated Podzols.

Exchangeable potassium ranges from low to extra high. In cultivated soils potassium applications would be necessary where the analyses are low, as in the Podzol, Gleysol and Organic soils. Exchangeable sodium is low in all of the soils.

Table 5 - CHEMICAL ANALYSIS OF FOURTEEN PROFILES AND SIX COMPOSITE SURFACE SAMPLES OF EAGLE VALLEY SOILS

Horizon	Depth Inches	pH 1:1	Organic Matter %	Total Nitrogen %	C/N Ratio	P.P.M. Available P	P.P.M. Available S	Exchangeable Cations and Exchange Capacity Milli-equivalents per 100 grams of soil: Ca	Mg	K	Na	Total	Cation Exchange Capacity	Base Saturation %
Gardom Series - Peaty Gleysol soils														
H	10 - 0	*4.7	67.5	2.33	16.8	6	-	14.1	0.1	0.1	0.1	14.4	40.0	3[illegible].0
Cg-H	0 - 7	5.3	12.3	0.37	19.4	9	-	2.0	0.1	0.1	-	2.2	26.8	8.2
IICg1	7 -21	5.3	1.6	0.05	18.2	22	13	**0.3		0.1	-	0.4	3.2	9.4
IICg2	21 +	4.9	-	-	-	10	-	-	-	-	-	-	-	
Hupel Gravelly Loamy Sand - Minimal Podzol soils														
L-H	1 - 0	*5.9	-	-	-	-	-	-	-	-	-	-	-	-
Bf1	½- 3	6.5	1.6	0.06	15.7	73	5	2.7	0.2	0.1	-	3.0	13.4	22.4
Bf2	3 -10	6.6	1.2	0.06	11.3	45	11	1.8	0.1	0.1	-	2.0	9.5	21.1
IIC1	10 -22	6.2	-	-	-	-	-	-	-	-	-	-	-	-
IIC2	22 +	6.1	-	-	-	-	-	-	-	-	-	-	-	-
Legerwood Silt Loam - Rego Gleysol soils														
Ap	0 - 8	5.3	9.7	0.43	13.1	6	16	7.7	0.2	0.2	0.1	8.2	28.0	29.3
Cg1	8 -17	5.9	1.5	0.07	12.8	8	9	2.6	0.1	0.1	0.1	2.9	8.7	33.3
Cg2	17 -29	6.0	3.1	0.11	16.2	11	9	3.9	-	0.1	0.1	4.1	11.8	34.8
Cg3	29 -38	6.1	1.5	0.06	14.0	19	9	2.3	0.1	0.1	0.1	2.6	6.8	38.2
Cg4	38 -46	6.1	2.7	0.11	17.6	22	11	3.0	0.5	0.1	0.1	3.7	12.2	30.3
IICg	46 +	6.1	0.6	0.02	17.7	11	-	-	-	-	-	-	-	-

Table 5 - continued

Hori-zon	Depth Inches	pH 1:1	Organic Matter %	Total Nitro-gen %	C/N Ratio	P.P.M. Avail-able P	P.P.M. Avail-able S	Exchangeable Cations and Exchange Capacity Milli-equivalents per 100 grams of soil						
								Ca	Mg	K	Na	Total	Cation Exchange Capacity	Base Satura-tion %
Malakwa Gravelly Sandy Loam - Minimal Podzol soils														
L-H	1½- 0	*4.0	-	-	-	-	-	-	-	-	-	-	-	-
Bfh1	¾- 4	5.7	5.6	0.16	20.2	15	10	2.4	-	0.1	-	2.5	24.9	10.0
Bfh2	4 - 8	6.1	4.5	0.13	20.2	11	10	1.7	0.2	0.1	-	2.0	19.8	10.2
BC	8 -15	5.9	1.7	0.06	16.9	25	20	**0.7		0.1	-	0.8	8.6	9.3
IIC	15 +	5.9	-	-	-	-	-	-	-	-	-	-	-	
Rumball Silt Loam - Gleyed Orthic Regosol soils														
Ar	0 - 6	5.9	2.1	0.08	14.9	15	1.5	9.1	1.7	0.3	0.1	11.2	15.4	72.7
IICg	6 -15	6.5	0.4	0.02	13.2	11	1.5	2.6	2.0	0.1	0.1	4.8	6.5	73.8
Cg1	15 -24	5.6	0.7	0.04	9.1	9	9	18.5	5.4	0.4	0.3	24.6	33.6	73.2
Cg2	24 +	6.0	0.4	0.03	9.1	11	11	11.0	3.6	0.2	0.3	15.1	19.2	78.6
Shuswap Sandy Loam - Minimal Poszol soils														
L-H	1¼- 0	*4.0	-	-	-	-	-	-	-	-	-	-	-	-
Ae	0 - 1	4.2	1.9	0.05	22.0	5	2.5	**0.3		0.1	0.1	0.5	6.1	8.2
Bf1	1 - 6	5.9	2.1	0.06	19.4	6	28	**0.5		0.1	-	0.6	13.9	4.3
Bf2	6 -11	6.2	0.4	0.02	12.9	76	7.5	**0.8		0.1	-	0.9	4.6	19.6
BC	11 -19	6.0	0.3	0.02	7.3	31	2.5	0.8	0.4	0.1	0.1	1.4	3.4	41.2
C	19 -26	6.2	-	-	-	4	-	1.3	0.2	0.1	-	1.6	2.8	57.1
IIC	26 +	6.4	-	-	-	-	-	-	-	-	-	-	-	-

Table 5 - continued

Hori-zon	Depth Inches	pH 1:1	Organic Matter %	Total Nitro-gen %	C/N Ratio	P.P.M. Avail-able P	P.P.M. Avail-able S	Exchangeable Cations and Exchange Capacity Milli-equivalents per 100 grams of soil: Ca	Mg	K	Na	Total	Cation Exchange Capacity	Base Satura-tion %
Sitkum Gravelly Sandy Loam - Orthic Podzol soils														
L-H	1 - 0	*5.4	-	-	-	-	-	-	-	-	-	-	-	-
Ae	0 - 1	5.0	2.1	0.06	20.5	9	-	1.8	0.3	0.1	0.1	2.3	7.2	31.9
Bfh1	1 - 3	5.6	9.4	0.23	23.8	8	58	**1.2		0.1	-	1.3	43.7	3.0
Bfh2	3 -10	5.6	4.9	0.14	20.2	11	100	**0.5		0.1	-	0.6	25.2	2.4
IIC	10 +	5.5	-	-	-	-	-	-	-	-	-	-	-	-
Solsqua Silt Loam - Orthic Gray Wooded soils														
L-H	1 - 0	*5.9	57.5	0.96	34.8	62	-	-	-	-	-	-	-	-
Ae1	0 - 3	6.4	1.3	0.06	12.3	131	2	6.0	0.6	0.6	0.1	7.3	13.3	54.9
Ae2	3 - 5	6.7	0.8	0.04	11.5	62	5	8.8	0.9	0.2	-	9.9	13.5	73.3
Bt1	5 -12	6.5	0.5	0.03	9.3	17	2	10.3	1.7	0.1	-	12.1	15.7	77.1
Bt2	12 -18	6.5	0.4	0.03	8.0	11	2	11.9	2.1	0.1	0.1	14.2	17.3	82.1
C	18 -30	6.7	-	-	-	7	2	9.4	1.7	0.1	0.1	11.3	13.1	86.3
IIC	30 -39	6.7	-	-	-	4	-	-	-	-	-	-	-	-
IIIC	39 +	7.1	-	-	-	5	-	-	-	-	-	-	-	-
Solsqua Silt Loam - Orthic Gray Wooded Composite Surface Samples														
#1	0 - 6	6.0	1.5	0.06	14.3	90	6	4.9	0.4	0.2	-	5.5	13.6	40.4
#2	0 - 6	6.6	3.1	0.11	16.3	137	5	6.3	0.7	0.8	-	7.8	17.8	43.8
#3	0 - 6	6.5	1.9	0.07	15.7	93	2.5	4.6	0.4	0.4	-	5.4	13.8	39.1
#4	0 - 6	6.9	1.1	0.05	12.8	98	4	7.4	0.2	0.4	-	8.0	12.5	68.0
#5	0 - 6	6.6	2.6	0.09	16.6	70	4	7.3	0.8	0.9	-	9.0	17.9	50.3
#6	0 - 6	6.8	1.8	0.07	14.9	100	3	5.2	0.3	0.6	-	6.1	13.0	46.9

Table 5 - continued

Horizon	Depth Inches	pH 1:1	Organic Matter %	Total Nitrogen %	C/N Ratio	P.P.M. Available P	P.P.M. Available S	Exchangeable Cations and Exchange Capacity Milli-equivalents per 100 grams of soil Ca	Mg	K	Na	Total	Cation Exchange Capacity	Base Saturation %
Syphon Sandy Loam - Brunisolic Gray Wooded soils														
L-H	2 - 0	*5.3	89.3	1.40	37.0	-	-	-	-	-	-	-	-	-
Ae1	¼-10	6.5	3.1	0.05	34.1	175	-	3.5	0.9	0.6	0.1	5.1	13.8	36.9
Ae2	10 -19	6.5	0.3	0.01	13.4	8	-	2.1	0.6	0.2	0.1	3.0	3.9	76.9
AeBt	19 -27	6.3	0.3	0.02	7.4	11	-	7.4	4.4	0.5	0.1	12.4	15.3	81.0
IIBt	27 -36	6.2	0.4	0.03	7.7	15	-	16.1	9.6	1.0	0.2	26.9	32.5	82.8
IIC	36 +	6.5	0.5	0.03	10.6	14	-	20.6	13.7	1.2	0.2	35.7	42.7	83.6
Taft Sandy Loam - Orthic Podzol soils														
L-H	1½- 0	*4.4	-	-	-	-	-	-	-	-	-	-	-	-
Ae	0 - 2½	4.9	2.5	0.03	48.3	25	8	**1.0		0.1	0.1	1.2	6.8	17.6
Bf1	2½- 7	6.1	2.3	0.07	19.4	48	25	**0.8		0.1	0.1	1.0	20.6	4.9
Bf2	7 -11	6.1	0.8	0.03	14.7	69	9	**0.5		0.1	0.1	0.7	6.9	10.1
BC	11 -17	6.1	0.4	0.02	10.5	51	-	**0.4		-	0.1	0.5	4.1	12.2
C	17 +	6.1	-	-	-	51	5	**0.2		-	0.1	0.3	1.7	17.6
Tappen Silty Clay Loam - Orthic Gray Wooded soils														
L-H	1 - 0	*6.5	89.1	1.55	33.3	-	-	-	-	-	-	-	-	-
Ae	0 - 2½	6.1	1.5	0.07	12.6	93	1	7.9	1.5	0.9	0.1	10.4	14.1	73.8
AB	2½- 4½	6.3	1.2	0.06	10.9	67	1	7.8	1.5	0.8	0.1	10.2	13.9	73.4
Bt1	4½-10	6.4	0.9	0.05	9.8	43	1	12.1	3.7	1.1	0.1	17.0	21.1	80.6
Bt2	10 -20	6.1	0.9	0.04	11.7	37	2	20.2	7.0	1.4	0.1	28.7	33.8	84.9
BC	20 -24	6.2	0.4	0.03	7.5	64	1	15.6	5.7	0.9	0.1	22.3	24.1	92.5
C1	24 -40	6.3	0.4	0.03	7.3	25	1	19.4	6.8	0.7	0.1	27.0	30.1	89.7
C2	40 +	6.8	0.4	0.03	7.3	15	3	15.8	4.0	0.4	0.2	20.4	22.1	92.3

Table 5 - continued

Horizon	Depth Inches	pH 1:1	Organic Matter %	Total Nitrogen %	C/N Ratio	P.P.M. Available P	P.P.M. Available S	Exchangeable Cations and Exchange Capacity Milli-equivalents per 100 grams of soil Ca	Mg	K	Na	Total	Cation Exchange Capacity	Base Saturation %
Wap Gravelly Sandy Loam - Orthic Podzol soils														
L-H	2 - 0	*4.0	-	-	-	-	-	-	-	-	-	-	-	-
Ae	0 - $1\frac{1}{2}$	4.2	3.7	0.14	15.3	13	14	**1.5		0.2	0.1	1.8	10.3	17.5
Bfh	$1\frac{1}{2}$ - 6	5.8	4.8	0.09	30.8	17	26	**1.2		0.1	0.1	1.4	27.6	5.1
Bf	6 - 10	5.8	1.1	0.03	21.3	60	5	**0.9		0.1	0.1	1.1	8.0	13.8
IIC	10 - 18	5.8	0.4	0.02	11.5	60	2.5	**0.5		-	0.1	0.6	4.3	14.0
IIIC	18 +	5.8	-	-	-	39	2.5	**0.8		-	0.1	0.9	3.9	23.1
White Gravelly Sandy Loam - Orthic Brown Wooded soils														
L-H	1 - 0	*6.0	92.6	1.58	34.1	-	-	-	-	-	-	-	-	-
Bhfj	0 - 6	7.1	4.9	0.13	22.3	64	-	17.1	0.7	1.2	0.1	19.1	18.2	100.0
Bfj	6 - 11	7.4	2.7	0.07	21.4	25	-	-	-	-	-	-	19.5	-
BC	11 - 20	7.9	2.5	0.09	16.6	22	-	-	-	-	-	-	16.8	-
Ck	20 - 30	7.9	6.4	0.18	25.7	13	-	-	-	-	-	-	11.5	-
IICkC	30 +	8.2	0.7	0.03	14.0	25	-	-	-	-	-	-	2.0	-
Yard Sandy Loam - Orthic Regosol soils														
L-H	1 - 0	*6.5	59.1	1.08	31.8	52	-	-	-	-	-	-	-	-
Ahj	0 - $7\frac{1}{2}$	6.5	0.8	0.03	16.3	29	9	3.5	0.3	0.5	-	4.3	7.3	58.9
AC	$7\frac{1}{2}$-$12\frac{1}{2}$	6.2	0.6	0.02	18.0	15	6	3.4	0.1	0.1	-	3.6	6.2	58.1
C1	$12\frac{1}{2}$-24	6.7	0.3	0.01	16.0	3	5	2.4	0.2	0.1	-	2.7	3.7	73.0
C2	24 - 36	6.8	-	-	-	6	-	3.1	0.2	0.1	-	3.4	4.8	70.8
C3	36 +	6.9	-	-	-	4	-	3.2	-	0.1	-	3.3	4.2	78.6

*pH on a 1:5 forest litter/water ratio
**Calcium plus Magnesium

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Appendix A - MONTHLY AND ANNUAL PRECIPITATION, SNOWFALL AND MAY-AUGUST RAINFALL AT MALAKWA, 1924 TO 1962 (5)

Elevation: 1,400 feet
Data in inches

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Snow	May-Aug.
1924	4.83	1.63	0.69	1.50	1.93	2.17	1.37	3.55	1.74	2.11	1.38	2.91	25.81	63.25	9.02
1925	4.80	1.52	1.58	0.63	1.71	0.91	1.04	2.41	1.32	1.57	0.79	2.73	21.01	88.65	6.07
1926	3.42	1.65	0.84	1.35	2.35	0.56	0.37	2.20	2.42	3.10	2.32	4.43	25.01	88.80	5.48
1927	5.20	2.40	1.56	0.74	1.23	2.65	1.21	2.62	4.14	3.03	4.45	3.97	33.20	148.20	7.71
1928	2.69	0.86	3.46	2.74	2.21	3.22	0.81	0.15	0.93	2.89	1.34	0.87	22.17	42.70*	6.39
1929	4.05	0.65	0.99	1.11	1.28	2.74	1.14	2.02	0.94	2.65	1.50	4.23	23.30	80.30	7.18
1930	0.66*	3.89	2.14	1.50	3.12	2.60	0.22	1.34	2.11	3.24	0.86	2.86	24.54	77.10	7.28
1931	2.84	2.48	2.00	0.64	1.29	4.88*	0.03*	0.28	3.94	3.12	3.84	2.95	28.29	111.60	6.48
1932	3.50	5.15	3.74	1.89	1.09	1.37	1.01	2.06	2.48	3.50	4.15	3.60	33.54	127.40	5.53
1933	3.38	4.12	2.29	0.61	2.07	2.63	2.14	1.24	4.32	4.95	2.64	5.90	36.29	146.50	8.08
1934	4.25	0.64*	2.80	1.13	3.16	1.40	1.11	0.09*	4.18	3.19	3.03	5.23	30.21	87.30	5.76
1935	9.89*	1.72	0.35	0.99	1.07	3.09	2.94	1.01	1.52	2.28	4.15	2.14	31.15	149.90*	8.11
1936	2.71	2.63	3.55	0.97	1.09	1.85	0.67	0.34	0.62	0.33*	0.75*	2.02	17.53*	93.20	3.95
1937	3.77	2.92	2.03	0.96	1.60	4.55	2.27	2.69	0.91	2.54	5.14	1.82	31.20	122.10	11.11
1938	2.41	2.00	1.32	0.47	0.40*	1.04	0.96	1.50	1.65	2.38	3.07	6.00	23.20	.	3.90*
1939	5.55	3.32	1.07	0.67	2.74	2.93	1.39	0.35	1.52	5.45*	1.94	3.22	30.15	.	7.41
1940	4.11	3.87	4.19*	1.14	1.87	0.65	2.97	0.27	1.36	2.29	3.12	2.58	28.42	.	5.76
1941	1.86	1.99	1.24	1.15	2.49	3.11	1.52	2.65	8.07*	4.14	1.96	1.05	31.23	.	9.77
1942	3.82	2.20	2.04	1.27	1.94	2.40	1.58	1.48	2.57	2.85	2.60	3.54	28.29	.	7.40
1943	2.40	1.10	0.65	1.74	1.42	2.41	1.11	2.27	1.66	3.61	0.99	3.74	23.10	.	7.21
1944	3.34	1.94	1.62	2.01	2.28	2.24	1.71	2.93	5.72	3.45	2.58	1.50	31.32	.	9.16
1945	5.05	1.88	1.02	2.36	1.37	2.33	1.62	0.28	3.04	4.71	3.57	3.02	30.25	.	5.60

Appendix A - continued

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Snow	May-Aug.
1946	6.80	5.47*	1.51	2.58	1.39	3.60	1.00	1.55	1.27	3.27	4.30	5.56	38.30	.	7.54
1947	4.10	4.13	2.09	2.71	2.46	4.46	2.40	2.18	1.16	3.95	3.19	5.60	38.43	.	11.50
1948	1.86	5.36	1.95	3.59*	1.92	0.60	2.86	4.58	2.24	0.80	3.59	4.96	34.31	.	9.96
1949	1.74	4.97	0.14*	1.35	2.28	2.43	2.57	3.38	1.34	4.54	2.11	7.39*	34.24	.	10.66
1950	2.23	1.94	2.10	1.33	1.40	0.42*	1.23	2.46	0.60	4.27	2.39	5.51	25.88	.	5.51
1951	5.81	4.06	0.96	0.10*	1.10	1.01	1.52	0.83	2.58	3.40	1.65	4.00	27.02	.	4.46
1952	4.48	2.86	1.45	1.99	2.39	4.54	1.28	0.77	0.35*	0.84	1.29	3.07	25.31	.	8.98
1953	4.98	2.72	2.63	1.80	1.21	4.67	1.42	6.97*	1.94	4.35	3.41	5.32	41.42*	.	14.27*
1954	3.83	1.82	1.68	2.14	2.53	4.69	2.87	3.55	1.04	1.43	5.14*	3.85	34.57	.	13.64
1955	2.95	3.85	2.65	1.62	2.81	3.65	3.87*	0.43	2.40	2.91	4.99	4.02	36.15	.	10.76
1956	3.20	3.78	2.39	0.84	2.10	4.12	0.42	2.74	2.16	3.71	2.28	6.40	34.14	138.90	9.38
1957	4.67	1.90	1.77	1.28	1.25	4.13	1.49	3.60	1.14	2.76	1.59	4.78	30.36	133.80	10.47
1958	5.12	2.42	1.68	3.26	1.43	3.65	1.16	1.43	4.64	2.06	4.21	5.10	36.16	88.90	7.67
1959	4.18	3.41	2.38	1.87	3.91	2.69	1.15	3.33	7.16	4.49	4.01	2.45	41.03	122.90	11.08
1960	5.03	2.22	1.32	1.36	4.40*	3.90	0.27	3.42	3.05	3.95	2.48	3.91	35.31	113.40	11.99
1961	1.99	3.64	2.24	1.96	2.79	2.66	2.68	1.90	2.33	3.57	3.86	3.59	33.21	80.90	10.03
1962	3.25	0.91	1.92	2.08	1.50	1.98	2.46	3.63	2.91	2.24	3.40	4.01	30.29	106.70	4.57
High	9.89	5.47	4.19	3.59	4.40	4.88	3.87	6.97	8.07	5.45	5.14	7.39	41.42	149.90	14.27
Low	0.66	0.64	0.14	0.10	0.40	0.42	0.03	0.09	0.35	0.33	0.75	0.87	17.53	42.70	3.90
Average	3.87	2.72	1.85	1.52	1.96	2.69	1.53	2.07	2.45	3.07	2.82	3.84	30.40	108.60	8.25

Appendix B - MONTHLY AND ANNUAL PRECIPITATION, SNOWFALL AND MAY-AUGUST RAINFALL AT SICAMOUS, 1955 TO 1962 (5)

Elevation: 1,400 feet
Data in inches

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Snow	May-Aug.
1955	1.73	2.04	1.42*	0.64	1.78	2.68	2.74*	0.64*	1.80	1.95	4.07*	2.65	24.14	.	7.84
1956	2.38	2.87*	1.36	0.47*	0.46*	3.82	0.62	1.59	1.91	2.47	1.14*	5.18*	24.27	105.60*	6.48
1957	3.37	1.43	1.26	0.90	1.78	4.16*	1.41	2.70	0.87*	1.97	1.16	2.60	23.61	101.60	10.05
1958	3.55	1.73	1.42*	2.12*	0.84	3.44	0.80	1.31	3.12	1.58	2.74	3.96	26.61	52.30	6.39*
1959	3.15	2.31	1.11	0.69	3.53	2.43	1.86	2.71	4.82*	3.22*	4.00	1.15*	30.98*	91.70	10.53*
1960	4.17*	1.52	1.04*	1.33	3.85*	1.76*	0.18*	3.47*	1.98	2.97	1.22	2.74	26.23	85.70	9.26
1961	1.16*	2.57	1.38	1.72	2.04	2.80	2.39	1.56	1.77	2.58	2.93	2.64	25.54	47.60*	8.79
1962	2.42	0.19*	1.08	0.91	1.82	1.88	2.19	1.78	2.55	1.54*	1.72	2.78	20.86*	75.60	7.67
High	4.17	2.87	1.42	2.12	3.85	4.16	2.74	3.47	4.82	3.22	4.07	5.18	30.98	105.60	10.53
Low	1.16	0.19	1.04	0.47	0.46	1.76	0.18	0.64	0.87	1.54	1.14	1.15	20.86	47.60	6.39
Average	2.74	1.83	1.26	1.10	2.01	2.87	1.52	1.97	2.23	2.15	2.53	2.95	25.16	75.70	8.37

GLOSSARY

Alluvium - All materials moved and deposited by running water.

Acre-foot - The amount of irrigation water required to cover an acre to a depth of one foot.

Alluvial fan - A fan-shaped deposit of outwash at the toe of a slope where a tributary enters a main valley.

Available plant nutrients - Nutrients in the soil in condition to be taken up by plant roots.

Boulders - Fragments of rock over two feet in diameter.

Calcareous material - Material containing free calcium carbonate. It effervesces when treated with dilute hydrochloric acid.

Cobbles - Fragments of rock from three to 10 inches in diameter.

Colluvium - Poorly sorted material which accumulates at the base of steep slopes through the influence of gravity.

Concretions - Hard concentrations of soil cemented by certain chemical compounds into aggregates or nodules of various sizes and shapes.

Consistence - The mutual attraction of particles in a soil mass and their resistance to separation or deformation. It is described as loose, very friable, friable, firm, very firm, soft, slightly hard, hard or very hard.

Creep - Mass movement of soil or soil material down slopes primarily by gravity, but helped by saturation with water and alternate freezing and thawing.

Delta - An alluvial deposit at the mouth of a river or stream, more or less triangular in shape.

Delta terraces - Deposits of streams in temporary glacial lakes. When the drainage cycle declined to present levels they were left as high terrace-like deposits at the mouths of tributary valleys, which terminate abruptly where they enter a main valley that contained a lake.

Eluvial horizon - A soil horizon from which material has been removed in solution or water suspension.

Erosion - The wearing away of the land surface by running water, wind or other forces. It includes sheet, rill and gully erosion of soils.

Eolian deposits - Wind deposited sediments, such as loess and dune sand.

Farm delivery requirement - The amount of irrigation water required by a given soil type during an irrigation season, expressed in acre-inches or acre-feet. Sometimes referred to as the duty of water.

Floodplain - A river deposit subject to overflow. A floodplain is characterized by a series of lateral accretions near the river channel, and a gentle down-slope to a generally swamped inner margin. Fossil floodplains are chiefly floodplain remnants beyond the reach of high water.

Glacial till - An unsorted, generally unconsolidated, heterogeneous mixture of stones, gravel, sand, silt, and clay produced by glaciers and deposited during recession of the ice-front.

Glaciolacustrine deposits - Material carried by melt-water and deposited in temporary glacial lakes.

Gley - A soil process in which the material has been modified by a reduction process brought about by saturation with water for long periods in the presence of organic matter.

Gravel - Rock fragments from two millimeters to three inches in diameter.

Horizon - A layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics produced through the operation of soil-forming processes. The soil horizons are as follows:

Organic horizons

L - A layer of organic matter in which the plant remains can be identified.

F - A layer of partly decomposed organic matter. The plant remains can be identified, but with difficulty.

H - A layer of well decomposed organic matter. The plant remains cannot be identified.

Master mineral horizons

A - A mineral soil horizon or horizons formed at or near the surface in the zone of maximum removal of materials in solution and suspension and/or maximum accumulation of organic matter. It includes (1) horizons in which organic matter has accumulated as a result of biological activity (Ah), (2) horizons that have been eluviated of clay, iron, aluminium and/or organic matter (Ae), (3) horizons dominated by (1) and (2) above but transitional to underlying B or C (AB or A and B), (4) horizons markedly disturbed by cultivation or pasturing (Ap).

B - As used in this report, a mineral soil horizon or horizons characterized by one or more of the following (1) an enrichment of silicate clay, iron and aluminium (Bt, Bf) and (2) an alteration by hydrolysis or oxidation to give a change of color or structure, but does not meet the requirement of (1) above (Bm).

C - A mineral horizon or horizons comparatively unaffected by pedogenic processes operative in A and B, excepting the process of gleying (Cg), and the accumulation of magnesium carbonate and more soluble salts (Cca, Ck, Cs).

<u>Lower case suffixes</u>

c - A cemented (irreversible) pedogenic horizon.

ca - A horizon with secondary carbonate enrichment.

cc - Cemented (irreversible) pedogenic concretions.

e - A horizon characterized by removal of clay, iron, aluminium or organic matter. Usually lighter in color than the layer below.

f - A horizon enriched with iron. Usually redder in color than the horizon above or below.

g - A horizon characterized by chemical reduction and gray colors; often mottled (gley).

h - A horizon enriched with organic matter.

j - A horizon whose characteristics are weakly expressed (juvenile).

k - A horizon in which the presence of carbonates is indicated by visible effervescence with dilute acid.

m - A horizon slightly altered by hydrolysis and/or solution to give a change of color and/or structure.

p - A layer disturbed by man's activities; i.e., by cultivation or pasturing. Used only with the A horizon.

t - A horizon enriched with silicate clay.

Additional terms

(1) Lithologic changes are indicated by Roman numeral prefixes (II, III, with I assumed).

(2) Horizon subdivisions are shown with figures as suffixes (Ap1, Ap2, etc.).

(3) If more than one lower case suffix is required and if only one is a weak expression, then the "j" is linked to the suffix with a bar; i.e., Ahej.

Horizon boundary - The vertical width or thickness between soil horizon boundaries is defined as follows:

Abrupt - Less than an inch wide.

Clear - From one to two inches wide.

Gradual - From $2\frac{1}{2}$ to five inches wide.

Diffuse - More than five inches wide.

Humus - The well decomposed, more or less stable part of the soil organic matter.

Ice-rafted - Stones or other material transported and deposited by floating ice.

Illuvial horizon - A horizon that has received material in solution from some other part of the soil profile.

Kame - A more or less conical or irregular knoll, hummock or terrace-like deposit, usually composed of sand and/or gravel, originally deposited in irregular channels along the margin of a valley glacier, or in a crevasse in the ice.

Kettle - A depression formed in outwash by collapse of the surface after the melting of buried ice. Kettles vary in size. Some are dry; others contain ponds or swamps.

Leaching - The removal of constituents from the soil by percolating water.

Lime-plated - Precipitated clacium carbonate on stones or other materials.

Loess - Materials having a silty to very fine sand texture produced by glaciers as rock flour, and distributed by the wind.

Meander - One of a series of loop-like bends in the course of a river.

Mottled - Irregular spots or streaks of different colors in soils. They indicate oxidation and reduction caused by a fluctuating water table.

Orthic - A term that identifies the normal or central concept of a Great Soil Group. Other subgroups are departures from the Orthic.

Outwash - All materials washed out of melting glacier ice and deposited by melt-water streams.

Parent material - The unconsolidated geological material from which the solum of a soil develops.

pH - A logarithmic designation of the relative acidity or alkalinity of soils or other materials. The range of pH is as follows:

Extremely acid	pH 4.5
Very strongly acid	pH 4.5 to 5.0
Strongly acid	pH 5.1 to 5.5
Medium acid	pH 5.6 to 6.0
Slightly acid	pH 6.1 to 6.5
Neutral	pH 6.6 to 7.3
Mildly alkaline	pH 7.4 to 7.8
Moderately alkaline	pH 7.9 to 8.4
Strongly alkaline	pH 8.5 to 9.0

Plant nutrients - The elements taken in by the plant, essential to its growth, and used by it in the elaboration of its food and tissue. These include nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, zinc, boron, copper, manganese, and perhaps others obtained from the soil; and carbon, hydrogen and oxygen obtained chiefly from air and water.

Soil drainge - The frequency and duration of periods when the soil is free of saturation. The following drainage classes were used in this report:

Rapidly drained - Soil moisture seldom exceeds field capacity in any horizon except immediately after additions of water. Soils are free of mottling throughout the profile.

Well drained - Soil moisture in excess of field capacity does not remain in any horizon for a large part of the growing season. Soils are free of mottling in the A and B horizons, but may be mottled in the C horizon or below depths of several feet.

Moderately well drained - Soil moisture in excess of field capacity remains for a small but significant part of the growing season. The soils are mottled in the B and C horizons. The Ae horizon may be slightly mottled in fine textured soils or in medium textured soils that have a slowly permeable layer beneath the solum. In grassland soils the B and C horizons may be faintly mottled and the A horizon is thick and dark.

Imperfectly drained - Soil moisture in excess of field capacity remains in subsurface horizons for significant periods during the year. In grassland soils, mottling usually occurs immediately below the A horizon.

Poorly drained - Soil moisture in excess of field capacity remains in all horizons for a large part of the year. In poorly drained grassland soils there is generally a thickened mucky surface horizon underlain by yellowish to bluish subsoil with or without mottling.

Very poorly drained - Free water remains at or within 12 inches of the surface most of the growing season. In grassland soils very poor drainage is generally accompanied by a thin, mucky surface horizon underlain by yellowish to bluish subsoil with or without mottling.

Soil profile - A vertical section through all soil horizons and extending into the parent material.

Solum - That part of the soil profile above the parent material in which soil formation is taking place.

Soil structure - The morphological aggregates in which soil particles are arranged. The following types of soil structure are mentioned in this report:

Blocky - Block-like aggregates with sharp, angular corners.

Granular - More or less rounded, with no smooth faces and edges.

Massive - A cohesive mass of soil, with no observable aggregation of particles.

Platy - Thin, horizontal plates; the horizontal axis is longer than the vertical one.

Prismatic - Large aggregates with the vertical axis longer than the horizontal. The surfaces and edges are well defined and the tops are usually flat.

Single-grained - Each grain by itself, as in sand.

Subangular blocky - Block-like aggregates with rounded corners. The horizontal and vertical axes are about the same length.

Stones - Rock fragments over 10 inches but less than two feet in diameter.

Stratified - Composed or arranged in strata or layers. The term is applied to water-sorted geological materials from which soils are derived.

Stream braiding - In shallow water a stream loaded with fine sediments may choke its channel with deposits, then overflow and cut new channels. When repeated this process is called braiding.

Submarginal soils - Soils that are unsuitable for a given purpose.

Talus - Rock fragments and soil material accumulated at the foot of a cliff or steep slope, chiefly by gravity.

Terrace - A relatively flat, horizontal or gently inclined plain. Terraces are usually long and narrow along valley sides, with a steep slope to the river on one side, and to another terrace or valley side on the other.

Texture - Soil texture is based on the amount of sand, silt and clay a soil may have. Sand consists of particles ranging in size from 2.0 to 0.05 mm, silt from 0.05 to 0.002 mm, and clay is composed of all particles smaller than 0.002 mm.

Topography - The following topographic classes and slope percentages have been used:

Simple topography (single slopes; regular surfaces)

	Symbol	Percent Slope
Depressional to level	A_1	0 to 0.5
Very gently sloping	A_2	0.5 to 2
Gently sloping	A_3	2 to 5
Moderately sloping	A_4	6 to 9
Strongly sloping	A_5	10 to 15
Steeply sloping	A_6	16 to 30
Very steeply sloping	A_7	31 to 60
Extremely sloping	A_8	Over 60

Complex topography (multiple slopes; irregular surfaces)

Very gently undulating	B_1	0 to 0.5
Gently undulating	B_2	0.5 to 2
Undulating	B_3	2 to 5
Gently rolling	B_4	6 to 9
Rolling	B_5	10 to 15
Strongly rolling	B_6	16 to 30
Moderately hilly	B_7	31 to 60
Hilly	B_8	Over 60

Water table - The upper limit of that part of the soil profile or underlying material that is wholly saturated with water.

Weathering - The physical and chemical disintegration and decomposition of rocks and minerals.